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LONDON'S ENVIRONMENT REVEALED

State of the Environment Report for London, June 2011
Data updates, February 2013

Environment Agency

NATURAL ENGLAND

Forestry Commission England

MAYOR OF LONDON

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Please consider the environment before printing this report

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Foreword

Foreword by Boris Johnson (Mayor of London), Howard Davidson (Director, South East, Environment Agency), Adam Wallace (Area Manager, London, Natural England) and Craig Harrison (London Manager, Forestry Commission).

London's unique liveliness, culture and diversity make it one of the most dynamic cities to live and work in. It is a world class city, a place where eight million people live and more than 300 languages are spoken.

As an economic engine for the UK, London attracts investment and growth, and is a hub for finance and tourism. Its strengths lie in the arts, commerce, education, entertainment, fashion, finance, healthcare, media, professional services, research and development, tourism and transport, all contributing to its prominence. Essential to these characteristics is its environment.

This London State of the Environment Report – 'London's Environment Revealed' - is produced by a partnership of the Greater London Authority, the Environment Agency, Natural England and the Forestry Commission.

The report looks at the state of London's environment today and highlights the improvements that have been made and the challenges we face. The report also features many local projects and schemes that have improved London's environment in recent years. The report identifies improvements to Londoners' quality of life through cleaner streets, a greener city, greater access to green spaces, and improved access to public transport.

The report has identified some big improvements to London's environment since 2000, principally in waste and recycling, public transport, wildlife habitats and urban greening.

In particular, we would like to draw your attention to some notable changes highlighted through the data updates:

- Local authority collected waste sent to landfill has declined by 41%, to 31%.
- Incineration has increased by 62%, following the opening of the Belvedere Incinerator, and is now at 36%.
- Recycling and composting continue to rise.
- Around 19,000 hectares of habitat have been enhanced and 5,000 restored.
- 37 more parks and greenspaces have the green flag award.
- More land affected by contamination has been returned to beneficial use.
- London experienced a serious drought and occurances of heavy rainfall.

Of course, London still faces some big challenges from a growing population, a changing climate and the current economic situation. We need to do more to reduce the impact of our activities on the environment, particularly through reducing energy use and carbon emissions, minimising the amount of waste we produce and send to landfill, and reducing our consumption of water to lessen the amount taken from the environment.

Brent reservoir
Source: Natural England

These challenges also present opportunities to create a sustainable green economy. We have the chance to ensure sustainable economic growth, create jobs and reduce environmental pollution and resource depletion in our capital city. Through developments in renewable energy, green buildings and cleaner transport we can continue to enhance the quality of life for Londoners.

The partnership looks forward to providing data updates and monitoring progress against the environmental indicators presented in the report.

We hope you enjoy the read.

Boris Johnson, Mayor of London

Adam Wallace, Area Manager
(Natural England)

Howard Davidson, Director
(South East, Environment Agency)

Craig Harrison, London Manager,
Forestry Commission

Executive summary

This is partnership report on the State of the Environment in London, is produced by the Greater London Authority, the Environment Agency, Natural England and the Forestry Commission. The report looks at how the environment has changed since 2000, where data is available.

Overall, the quality of London's environment is improving despite the challenges from a growing population and climate change. This report uses a series of indicators to illustrate the changes in the state of the environment within eight themes, aligned to each chapter. The chapter summaries below identify the main outputs from each indicator. This is also highlighted in the indicator summary table.

Chapter 1: Climate change

Emissions of carbon dioxide and other greenhouse gases from the production, supply and use of energy are contributing to climate change. The resulting rise in temperature and changing rainfall patterns will mean London is more likely to experience an increased risk of floods, droughts and heat waves.

Population growth in London is likely to further increase emissions, but this report has identified a decoupling between emissions and growth over the last decade. Emissions have fallen by 5% since 2005 despite a rising population. However, current emissions only represent a reduction of 1% on 1990 levels, due to rising emissions between 1990 and 2000. Progress with the Mayor's target to reduce carbon emissions to 60% below 1990 levels by 2025 [i] will be monitored.

At 5.7 tonnes per person, London's CO_2 emissions are 28% lower than the UK average of 7.9 tonnes CO_2 per person (2010). This is largely due to the efficient public transport system and lower use of private vehicles in the capital.

Energy use in the capital fell by 9% between 2005 and 2009. This reduction has been driven predominantly by changes in the industrial and commercial sector as businesses in the capital become less energy intensive. Total energy use from this sector has fallen from approximately 5,000 Gwh but the percentage of total energy use has stayed constant at around 37%.

The use of energy in our homes has stayed relatively constant since 2000, accounting for around 41% of London's total energy use in 2009. Making our homes more efficient can therefore make a significant impact on overall energy use in the capital. Initiatives such as the RE:NEW programme are looking at implementing energy efficiency measures in homes across London.

Chapter 2: Flood risk

High housing density and development on the floodplain means London has just over 536,000 properties in the floodplain. Around 30,000 of these are in areas which have a significant likelihood of flooding; this is mainly from London's freshwater rivers.

Currently 87% of the properties at risk of flooding, from rivers and the sea, in London have a low likelihood of flooding due to the presence of flood defences. The most significant of these is the Thames Barrier, which has protected London from flooding 119 times since it became operational in 1982. As the climate changes, closures of the Thames Barrier are expected to become even more frequent; mean tide levels at Southend on Sea in the Thames Estuary are rising is in relation to the Ordnance Datum Newlyn level (Country baseline) and more frequent and heavy rain storms will increase rainwater run-off into the freshwater tributaries. However, the Thames Barrier will continue to protect London from tidal

flooding until 2070 as plans are put in place to adapt to the changing climate.

In London, the most significant opportunities for reducing flood risk are through redevelopment and improving flood defences. Schemes to improve existing defences and construct new ones have reduced the risk of flooding to around 78,000 properties in London over the last five years.

London is particularly vulnerable to surface water flooding. After intense storms, the concrete urban surfaces prevent water from being absorbed into the ground and the drainage system can be overwhelmed by the additional volume. The Drain London Forum has assessed the risk and extent of surface water flooding in London, for the first time.

Chapter 3: Water quality

The River Thames and its tributaries provide valuable habitat, supporting a variety of wildlife, and providing a source of water for the capital. Protecting and improving the quality of the water environment is vital for people and nature.

The EU Water Framework Directive has changed the way we measure water quality. It takes a holistic approach to river basin management, and requires the assessment of the quality of all water bodies, looking at the status of the water chemistry, biology and ecology. One of the 47 river water bodies in London is classified as having good ecological status. A further 30 are classified moderate and 16 are poor (2009). Many organisations across London are involved in investigations and projects to improve the quality of London's water bodies over the coming years.

The water quality of the Thames Estuary in London is threatened by discharges of storm sewage and combined sewer overflows. These discharges occur following heavy rainfall to prevent the sewer network from being overwhelmed by the rainwater entering the system. On average, around 39 million tonnes of storm sewage are discharged into the Thames Estuary each year, reducing dissolved oxygen levels and the river's ability to sustain life.

Of the water pollution incidents that have an environmental impact, 5% are considered serious. Occurrences of serious incidents have fallen by 69% since 2002, with 15 recorded in 2011. These are predominantly caused by authorised discharges of storm sewage. The Thames Tideway Improvements Programme aims to improve background water quality and address the problems caused from storm sewage overflows.

Chapter 4: Water resources

Ensuring there is enough water available for people and the environment, as the climate changes and population increases, is critical to managing the supply and demand for water in the capital. There has been a 2% reduction in the amount of water used in our homes, since 2000/01, with current usage at approximately 164 litres per person per day. This is 14% more than the England and Wales average, despite London being in one of the driest parts of the country.

Water lost through leakage in supply pipes is a wasted resource. Significant progress has been made to reduce leakage in London; since the peak in 2003/04 there has been a 37% drop in the amount of water lost per property per day. However, London leakage is still around 167 litres per property per day compared to a national average of 127. The old infrastructure, and the resulting traffic disruption from replacing mains, means leakage reduction is challenging in London, but significant progress is being made to reduce this.

London's rivers have enough water to support good biodiversity all of the time, except for the lower and middle sections of the River Lee. A large proportion of London's drinking water supply comes from the River Lee, which reduces the

river flow. The changing climate is expected to affect river flows in future; as rainfall patterns change and temperatures rise. Managing the amount of water abstracted is vital to ensure a balance between future supply and a healthy river.

Chapter 5: Waste

Prevention is the first stage of the waste hierarchy; where less waste is produced, less needs to be disposed of. Each year, Londoners are consistently reducing their household waste. The capital is now producing 12% less household waste than in 2000 and residents are recycling and composting more of their household waste than ever - at 34% of all household waste.

Reducing the amount of waste sent to landfill will reduce the emissions of greenhouse gases produced as waste decomposes. Ten years ago, 72% of the capital's local authority collected waste went to landfill. Significant steps have been taken to reduce this and it now accounts for 31%, with around 1.1 million tonnes of London's waste land-filled in 2011/12.

Litter on London's streets is an issue of concern for residents – it has been identified as the primary issue affecting environmental quality in the capital[ii].

Chapter 6: Air quality, transport and noise

Air pollution has significant impacts on people and the environment; it can increase the risk of respiratory diseases and affect the biodiversity of roadside plants and trees. Progress has been made in reducing air pollution in London; however, the level of decline has slowed in the last 10 years. This is clear when looking at long term trends in concentrations of air pollutants, such as particulate matter and nitrogen dioxide, in the capital. Levels of nitrogen dioxide (NO_2) (which is mainly derived from road transport) in inner London exceed the ambient concentration annual limit of 40ug/m^3. Levels of particulate matter PM_{10} exceed the ambient concentration 24-hour limit value of 50ug/m^3. These problems are not specific to London; as these air pollutants are mainly derived from transport, they are experienced in many urban environments. Similar levels are often recorded in cities such as Paris, Madrid and Athens.

There has been a fundamental shift towards public transport use in the capital, despite a rising demand for travel. Public transport now accounts for 42% of all London's journeys, compared to 36% for private transport, and carbon emissions have shown a corresponding reduction. Improvements to public transport networks and provision of lower emission transport options, such as hybrid and hydrogen buses, and more cycle lanes and cycles for hire, have encouraged more residents and visitors to swap their car for a less polluting alternative.

Chapter 7: Biodiversity

London supports many important species and habitats. As London's wildlife sites and habitats are enhanced, in both condition and extent, their biodiversity values increases. There are currently around 1500 Sites of Importance for Nature Conservation (SINC), covering 30,000 hectares (ha). This includes 36 Sites of Special Scientific Interest (SSSI). The condition of London's SSSIs has improved between 2000 and 2010, from 73% in favourable or recovering condition to 92%. There were particular improvements from 2007 onwards as the condition of large sites improved e.g. the wetlands of the Inner Thames Marshes, including Rainham Marshes, and Richmond Park. The overall condition of London's SSSIs has improved to 93% in favourable or recovering condition in 2012.

All types of habitat in London are being restored and enhanced. Between 2000 and 2011 approximately 39,000 hectares of habitat have been enhanced and around 18,000 hectares have been restored in London. Measures are in place

to meet the restoration targets outlined in the London Biodiversity Action Plan.

Populations of bird and fish species have shown general improvements, increasing by 15% since 2004, but some species, including the house sparrow, have shown a declining trend. Fish populations have been impacted upon by pollution in London's rivers, particularly in the River Wandle, and also by obstructions blocking the movement to fish along rivers. Under the definitions of the EU Water Framework Directive, only six of London's water bodies have the expected diversity of fish species. Habitat enhancements will further help to strengthen fish populations and species diversity in London's rivers.

Chapter 8: Landscape and green infrastructure

Despite being a megacity, London boasts outstanding green spaces and parks which cover around two thirds of the capital. More Londoners now have access to green space in the capital. Areas deficient in access to nature have fallen from 34,240 ha in 2006 to 24,816 ha (16% of London) in 2010. Improvements in access to existing sites and developing access to sites that were previously inaccessible led to this change.

Brownfield land can be damaged or contaminated from previous use, but it can also have biodiversity value. However, developing on Brownfield land reduces the pressure on London's green spaces and brings the land back into beneficial use. Development can also help to remediate contaminated land, improve the quality of the landscape and manage any loss of habitat through living roofs and other biodiversity projects. The total area of Brownfield land in London has increased by around 200 ha since 2000, but there has been a significant reduction in the area of derelict land. In London 97% of new properties were built on Brownfield land in 2008, well above the England average of 77%.

A recent study on private garden cover has shown that the overall area of vegetation in London's gardens has declined from 25,000 ha to 22,000 ha since 1998-99, as lawns and flowerbeds are replaced with hard surfaces, such as patios and parking areas. Hard-surfacing of front gardens is no longer permitted unless the surface is porous or greening measures are included. Urban greening measures, such as the implementation of green roofs, have increased significantly over the last few years, with an estimated 500,000m^2 now installed across London.

Such measures will go some way to mitigate the impact of changes to garden design and management by providing replacement habitat and measures to reduce surface water flooding.

The number of green spaces in the capital that have been awarded the Green Flag has increased since 2000, reaching 264. The Mayor's Street Tree programme planted 10,221 trees between 2008 and 2012, and a further 65,000 trees are planned as part of the 'Big Tree Plant' between 2012 and 2015.

Allotments are increasing in popularity in London; there has been a 13% increase in sites but waiting lists are still long in some boroughs. Allotment land covers around 1,000 ha, providing vegetated land cover and urban wildlife corridors as well as food growing spaces in the capital.

Indicator summary table

The table below summarises the current status for each environmental indicator, progress with any targets and how it has changed over the last 12 years. The indicators used in this State of the Environment report were chosen to provide an overview of the current status, along with the changes identified since 2000, for each environmental theme. We have chosen datasets that provide compelling evidence, which provides a snapshot of the current state of the environment and can be used to monitor future progress. The status of each indicator is also shown on the indicator pages throughout this report.

KEY

Declining trend (getting worse) | Improving (some progress) | Improving (significant progress) | No trend

No	Indicator name	Current status	Trend - since 2000	Trend comment
1	Carbon dioxide (CO_2) emissions	44.7mt/CO_2 (2010). This is equivalent to around 5.7 tonnes per person per year.		CO_2 emissions in London have reduced by 5% since 2005; and is only a 1% reduction relative to 1990 levels.
2	Energy consumption	141,984 Gwh (2010)		Total energy use in London has reduced by 9% since 2005, and shows year on year reductions.
3	Properties at risk of flooding	30,000 (6%), of the 536,000 properties at risk of flooding from rivers and the sea are in areas with a significant likelihood of flooding. 87% have a low likelihood due to defences.		Trends over time cannot be accurately drawn for this dataset – comparative data are not available due to changes in methodology. It provides an indication of the current situation.
4	Sea level change	Sea level at Southend is rising. The Thames Barrier was not closed in 2011.		Mean tide levels at Southend-on-Sea are rising relative to the ODM; the Thames Barrier has been closed 119 times since 1983 to manage flood risk.
5	Flood warnings issued	No Severe Flood Warnings have been issued in London since 2000.		Overall fewer warnings have been issued than in 2000, but it is hard to determine clear trends for this indicator due to the influence of rainfall patterns.
6	Freshwater quality: Ecological status	1 of the 47 river water bodies in London currently has good ecological status. 30 are moderate and 16 are poor status.		No trend is available for this indicator as the 1st formal classifications were published in 2009. The next formal statuses will be published in 2015.

7	Estuarine water quality: Dissolved oxygen levels	On average around 39 million tonnes of sewage discharged annually. Oxygenating vessels were deployed 28 times in 2011.		Dissolved oxygen levels drop below threshold levels on average around 52 days per year. There are fewer days below the standard level in recent years, but dissolved oxygen levels are still a big issue in the Thames Tideway.
8	Serious water pollution incidents	18 serious incidents were recorded in 2011: 4 category 1 and 14 category 2 incidents.		Serious water pollution incidents have fallen by 69% between 2002 and 2011. On average, major incidents occur around 2 times a year and significant incidents are generally declining.
9	Domestic water consumption	Average domestic water use is 164 litres per head per day (l/h/d).		A general reduction in demand is evident over the last 10 years. But consumption in London is 14% higher than the England and Wales average.
10	Leakage	London wide leakage is 167 litres per property per day.		Improvements in leakage mean rates, per property per day, have fallen by 11% since 2000 (and 37% since the peak in 2003/04). However, leakage in London is still the highest in England and Wales.
11	Water resource availability	London rivers support good ecology all the time, except for the middle and lower sections of the River Lee.		No trend is available for this indicator; the data identifies the current position. Future change will be based on the data presented.
12	Groundwater under London	Levels are -40 mAOD in central London, around 3m less than in 2000.		Management of groundwater levels in London means they are beginning to stabilise. However, levels have risen in west London by around 6 metres since 2000. Levels in central, east and south London have fallen.
13	Household waste prevention	2.98 million tonnes of household waste produced; 904 kg of waste produced per household.		The amount of waste generated per household, each year, has decreased by 216kg/hh since 2000/01; from 1120kg/hh to 904 kg/hh in 2011/12.
14	Recycling and composting	30% of local authority collected waste is recycled or composted.		- Recycling and composting of local authority collected waste has increased from 8% in 2000 to 30%, increasing year on year. - Recycling and composting of the household only component has again increased year on year, from 9% to 34%, but is still the lowest in England and below the 2010 target of 35%.
15	Landfill	31% local authority collected waste sent to landfill.		Local authority collected waste sent to landfill has reduced year on year since 2000 (from 72%), with significant reductions in 2011/12 as more is incinerated (rising to 36%).
16	Annual, daily and hourly mean pollutant concentrations	The limit values were exceeded for the NO_2 1-hour, NO_2 annual mean, PM_{10} 24-hour, and compliance was achieved with the PM_{10} annual mean[iii]		The rate of improvement in concentrations of particulate matter (PM_{10}) has been slower in the last decade than in the 1990s. Similarly, levels of nitrogen dioxide (NO_2) in London fell until 2002 but have remained relatively stable.
17	Road traffic levels and public transport	Public transport makes up 42% of all transport modes at the journey stage.		Public transport is becoming more popular. Mode share for public transport has increased by 8 percentage points, from 34% in 2000.

18	Aviation, rail and road transport (ambient noise)	74% of the TfL route network has a lower noise surface material. 54% of buses in the fleet are at least 2dB quieter than the required legal limit.		No trend can be drawn since 2000 for this indicator. Trends from the Defra noise mapping will be available when the second series of data is published in 2013. Trends from the Heathrow and London City Noise Action Plans are expected to be available from 2013 onwards.
19	Sites of Importance for Nature Conservation (SINC)	There are 1500 SINCs in London covering almost 30,000 ha. 93% of SSSIs are in favourable or recovering condition.		- The area of London SINCs has increased by 5% (~1,500 ha) between 2001 and 2012. - The percentage of SSSI area in favourable or recovering condition has improved from 73% in 2000 to 93% in 2012.
20	Improving condition and extent of London's habitat	Approximately 39,000 ha enhanced and 18,000 ha restored since 2000.		Making good progress towards the delivery of some Biodiversity Action Plan habitat targets.
21	Bird populations	Starling and House Sparrow are the most common species but both recording declines.		Populations of bird species in London have increased by 15% since 2004 but some species have declined.
22	Fish populations	40 species of fish are routinely recorded in the tideway each year.		Fish populations are generally improving in the tidal Thames and the freshwater tributaries, but many of London's water bodies are not yet achieving good fish status under WFD.
23	Green spaces	264 London parks and green spaces hold Green Flag awards. Around 297,000 ha of public open space are classified as areas of deficiency.		- The number of Green Flag awards has increased from 12 to 264 since 2000. - Areas of deficiency to nature have reduced from 23% to 16% of London (since 2005).
24	Bringing land back into beneficial use	Of the 3,730ha of Brownfield land, 268 ha is derelict. 1,440ha of contaminated land was brought back into beneficial use since 2000.		6% increase in the overall area of Brownfield land in London since 2002 and a 42% reduction in the area of derelict land. New homes built on Brownfield land has increased and surpasses the England average of 77%, at 97%.
25	Allotments and food production	London has around 25,000 allotment plots, covering around 1000 ha and currently 1,030 capital growth spaces.		13% increase in the total number of allotment sites since 2003.
26	London's garden cover	London has around 37,900 ha of garden land; 22,000 ha (57%) is vegetated cover.		The area of garden vegetation in London has declined from 25,000 ha to 22,000 ha since 1998-99, as lawns and flowerbeds are replaced with hard surfaces, such as patio and parking areas.
27	Urban Greening	Tree canopy covers around 21,9% of London. 26% of London's 13,000 hectares of woodland is managed. There is around 500,000m^2 of green roof (2008) and 500,000 street trees.		Green roof cover has significantly increased since 2004. More street trees have been planted but it is not yet certain whether this has offset the loss of trees resulting from development, safety issues and natural causes.

Power and Energy Monitor. Source: Environment Agency

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CLIMATE CHANGE IN LONDON

Carbon dioxide emissions in London are 1% lower than 1990 levels, at 44.7 million tonnes ($mtCO_2$). However, they have reduced by 5% since 2005.

Londoners are using 9% less energy than in 2005; 41% of all energy use is from the domestic sector.

Globally temperatures are rising. Projections for our future climate show that temperatures are likely to continue rising.

2000 to 2009 was the warmest decade on record (according to records dating back to the 1850s) and 2010 was the joint warmest year.

The 2009 UK Climate Projections (UKCP09)[iv] estimate that summers in London will be hotter and drier, and winters will be milder and wetter.

Climate change potentially poses a great threat to people and the environment in London. Rising temperatures and changing rainfall patterns mean that London could face an increasing risk of floods, droughts and heat waves. The changing climate will also affect the state of London's environment by adding further pressure to water quality, water resources and habitats.

There are two parallel approaches to address the impacts of climate change; limiting further impacts of climate change by reducing greenhouse gas emissions (mitigation), and preparing for changes and improving London's resilience to extreme weather and climate changes in the future (adaptation). The latter includes activities such as improving flood defences to withstand more extreme flood events, further urban greening to reduce overheating in the capital, and reducing water wastage to conserve water resources and limit the impact of droughts.

The indicators in this chapter represent activity on climate change mitigation. They assess trends in emissions of carbon dioxide (1 of the 6 primary greenhouse gases) from domestic, transport and industrial sources; and the consumption of energy through domestic activities, transportation and industry.

The reduction of emissions from the Olympic Park – through the Energy Centre - is highlighted in the chapter case study.

This report does not have explicit climate change adaptation indicators. Adaptation is notoriously difficult to measure; a minimum of a thirty year period is required to identify any climate (as opposed to weather) signal. A number of the indicators in this report however could serve as proxies for measuring adaptation e.g. flood risk (indicator 3) and water consumption (indicator 9). Activity in these areas can be representative of changes in the level of adaptation.

Indicator 1: Carbon dioxide emissions

Human activity – primarily the burning of fossil fuels (oil, coal, gas and petroleum) – has increased concentrations of greenhouse gases (GHGs) in the atmosphere since the industrial revolution. GHGs absorb the sun's energy reflected from the Earth and re-emit it towards Earth, resulting in a warming of the atmosphere. Carbon dioxide (CO_2) accounts for around 99% of all GHG emissions in London[v].

This indicator is a measure of London's CO_2 emissions, by sector. These are divided into emissions from the domestic, industrial and commercial, and transport sectors.

This indicator uses emissions data from the Department of Energy and Climate Change. The data is presented on an 'end user' basis; therefore emissions from the production and processing of fuel are reallocated to the consumers, to reflect the total emissions for each fuel use. The latest data available is 2010.

The indicator focuses on the trend since 2005 but reference has been made to 1990 to indicate progress against the target levels set in the London Plan 2011 (policy 5.1) and in the Mayor's Climate Change Strategy. These aim to achieve an overall reduction of 60% on 1990 levels by 2025. The next interim target is to achieve a 22% reduction on 1990 levels by 2015.

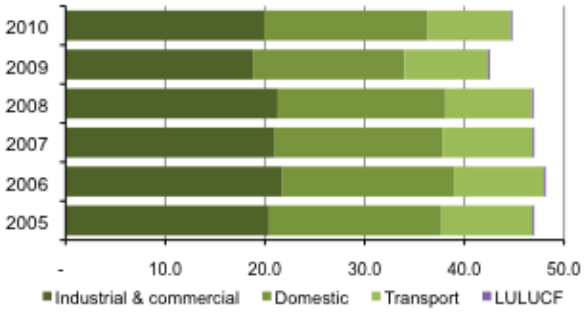
Analysis

- CO_2 emissions in London account for 9.4% of the UK total[vi].
- CO_2 emissions were 44.7 MtCO_2 in 2010. 45% were from industrial and commercial sources (19.9 Mt CO_2). Homes accounted for 37% (16.3 Mt CO_2) and the transport sector accounted for the remaining 19% (98.4 Mt CO_2) (Figure 1).
- Since 1990, London's CO_2 emissions have fallen by 1%, compared to the UK reduction of 24% on 1990 levels.
- Since 2005 (figure 1) the capital's annual emissions dropped by 5%. National electricity supply is less carbon intensive and there has been a shift towards the service industry, which is less energy intensive.
- At 5.7 tonnes per person per year, London's CO_2 emissions are the lowest in the country (on a regional basis).

This is, in part, due to high usage of the public transport system compared to greater reliance on private cars outside the capital.

Despite a rising population in London, carbon dioxide emissions have fallen over the last few years.

Figure 1
Carbon dioxide emissions by sector
Mt/CO2



Source: Department of Energy and Climate Change (DECC) 2012

Indicator 2: Energy consumption

This indicator is a measure of the amount of energy consumed in London. Energy is consumed through day to day activities in the home and workplace and through transportation and industry. Reducing overall energy consumption and being more efficient with the energy we do use is vital to reducing carbon emissions.

The rate of energy consumption and the type of energy consumed changes by season. In the winter months, consumption of gas is higher due to use of central heating to warm homes and businesses. However in the summer months, there is a general shift towards higher electricity use from air conditioning.

Data on energy consumption for London is taken from the Department of Energy and Climate Change (DECC). The data identifies the final energy consumption across the domestic, industrial and commercial, and transport sectors. The earliest data is 2005; therefore comparison to the 2000 baseline is not available.

Analysis

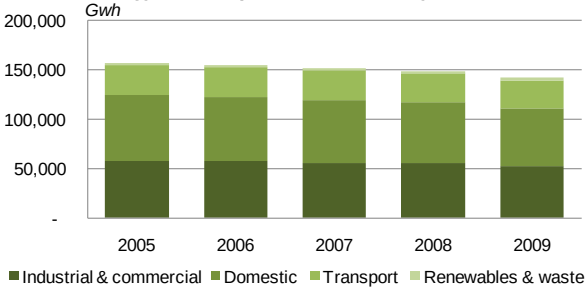
- London consumed 141,984 GWh of energy in 2009.
- 41% of the energy used in 2009 was consumed in London's homes (domestic), 37% from London's workplaces (the industrial and commercial sector) and 20% from the transport sector (Figure 2).
- Gas consumption (from homes and workplaces) makes up 47% of the total energy consumed in London; a reduction from 51% in 2005.
- Electricity consumption (from homes and workplaces) accounts for 29% of all the energy consumed in London; an increase from 26% in 2005. However, because of its higher CO_2 content it contributes proportionally more to London's overall CO_2 emissions.
- Coal (from homes and workplaces) makes up <1% of the total energy used; similar to levels in 2005. Almost all of this is from the industrial and commercial sector.
- 21% is from petroleum, primarily used in the transport sector – including rail transport. Consumption of petroleum has remained similar to 2005 levels.

There has been a 9% reduction in London's total energy consumption since 2005.

- 2% of consumption is from renewable energy sources and waste. This has increased since 2005 in terms of Gwh consumed, but not as a percentage.

Data on the production and use of renewable energy will be included in future updates to this report. The Greater London Authority is currently developing a methodology to measure and monitor the deployment of renewable energy in London.

Figure 2
Energy consumption in London, by sector



Local case study

Reducing greenhouse gas emissions: The Energy Centre at the London 2012 Olympic site.

London 2012 aimed to 'set new standards, creating positive, lasting change for the environment and communities'. The London 2012 Olympic Games was the first summer games to embed sustainability in planning from the start.

The Olympic Stadium
Source: www.London2012.com

The goal was to deliver a low carbon games[vii] through a suite of measures based on a hierarchy of: avoid/eliminate (design out emissions at the source), reduce, substitute/replace (measures to introduce renewables/lower carbon technologies) and compensate (measures to deal with residual or unavoidable emissions and promote behavioural change).

Part of being a 'sustainable games' means minimising greenhouse gas emissions from its activities. The 'Energy Centre' for the Games ensured efficient, low carbon heating, cooling and power for the venues and buildings across the Olympic Park. This successful method of decentralising energy could be replicated locally across London.

The Energy Centre:[viii]

- Supplies energy to local development, it is therefore more efficient because energy is not lost in transmission;
- Uses a Combined Cooling Heat & Power (CCHP) plant to capture the heat generated by electricity production, and will lead to carbon reductions of more than 1,000 tonnes per year.
- Was designed to accommodate future energy demands – with the capacity to supply energy to 10,000 homes and will therefore serve the new buildings and communities that will be developed following the Games, thereby delivering a legacy of essential services.
- Has other environmental benefits alongside reducing greenhouse gas emissions. These include:
  - Construction of the substation used crushed materials from the demolition of the former Kings Yard buildings – reusing waste materials on site.
  - A 'brown roof' that allows wildlife to colonise naturally and enhance the ecological value and biodiversity of the Olympic Park.

Aerial view of the Energy Centre
Source: www.London2012.com

Reducing emissions and improving energy efficiency: RE:FIT – London's public building retrofit programme

RE:FIT is a ready-to-use, spend to save procurement initiative that allows the public sector to retrofit existing buildings with energy saving measures, reduce carbon emissions and achieve substantial guaranteed annual cost savings.

Energy Service Companies (ESCos) install energy conservation measures in identified buildings and guarantee annual energy savings over an agreed payback period. This Energy Performance Contracting model transfers the risk of performance to the ESCos as they must guarantee the energy savings to be made over the agreed payback period.

To test and demonstrate the concept, pilot projects were carried out by Transport for London, Metropolitan Police and London Fire and Emergency Planning Authority on 42 of their buildings across London. Key results from these pilots were:

- 7,000 tonnes CO_2 reduction.
- Average 28% reduction in energy consumption.
- Payback period of seven years from capital investment of £7 million.

Following the success of the pilot, an OJEU compliant framework was established, which has recently been replaced with a new framework that introduces improvements, such as a range of funding options and simpler tendering.

The programme has been rolled out to the rest of the public sector in London, with the aim of facilitating the RE:FIT Energy Performance Contracting approach to at least 40% of public sector organisations, generating savings of up to £80 million in energy bills.

In September 2011 a Programme Delivery Unit (PDU) was established to manage the RE:FIT Framework, with funding provided by the GLA and European Commission under the ELENA (European Local Energy Assistance) Programme. Progress made from the RE:FIT programme to date is as follows:

- 111 buildings retrofitted, from a capital investment of over £13 million and an estimated CO_2 reduction of 12,000 tonnes per annum.
- 55 London public sector organisations are participating in the programme, consisting of 21 London Boroughs, 17 NHS Organisations and 17 other organisations such as central government, museums and education organisations
- The pipeline for November 2012 onwards currently includes 44 organisations with a total value exceeding £44 million, an estimated CO_2 reduction of 35,000 tonnes per annum and the retrofitting of over 400 public sector buildings.

Useful links and further reading

- The Mayor's draft Climate Change Adaptation Strategy (Feb 2010). This identifies the key climate risks to London and proposes and range of actions for the Mayor and other partners to implement to manage these risks.

- The Mayor's draft Climate Change Mitigation and Energy Strategy (Oct 2010)

- RE:NEW – the Mayor's home and water efficiency improvement programme

- RE:CONNECT – Low Carbon Zones

- Carbon emissions: London Plan 2011. Policy 5.1 (climate change mitigation) and policy 5.2 (minimising carbon dioxide emissions)

- Energy consumption: London Plan 2011. Policy 5.4 (retrofitting) and policy 5.5 (decentralised energy networks)

- UK climate impacts programme

- Department of Energy and Climate Change (DECC)

- London Climate Change Partnership

2

FLOOD RISK IN LONDON

Around 536,000 properties in London are in the floodplains of London's rivers. 87% of these are well defended but 30,000 properties (6%) have a significant likelihood of flooding due to lower standards of protection.

Sea level at Southend on Sea is rising. The Thames Barrier has been closed 119 times since 1983 to manage flood risk.

An average of 84 flood warnings have been issued annually in London since 2000; 87% of these are 'Flood Alerts' which advise that flooding is possible; no 'Severe Flood Warnings' have been issued since the 7 issued in 2000.

Flooding is a natural process and it is not possible to protect everyone and everything from flooding all of the time. London is particularly vulnerable to rapid river and surface water flooding after heavy storms. The risk of surface water flooding is exacerbated by the large area of impermeable urban surface in London - this increases the amount of rainwater run-off after intense rainfall and there are limited places for the water to go. The drainage systems and river channels in London can be overwhelmed by the high intensity of water entering them in a short space of time. This was particularly evident in 2000 and 2007 when homes and gardens in the capital were flooded.

The risk of tidal flooding in London, which results from a combination of high tides and stormy conditions, is very low due to protection from the Thames Barrier and associated tidal defences.

Effective management of flood risk will reduce the impacts of rising sea levels and increased storm intensity, as a result of climate change. In London, the two most significant opportunities for reducing flood risk are through redevelopment and the maintenance and improvement of existing defences. Planning policy encourages setting back developments from the river edge where there are particular flooding risks and to protect the effectiveness of defences. Planning for and adapting to climate change through methods such as the multi purpose use of open space, for example, parks will also help to reduce urban flood risk by allowing space for flood water during times of high flows.

The indicators in this chapter have been selected to give an overview of flood risk and its management in the capital. The risk of flooding to properties in London, from rivers and the sea, and the likelihood of flooding occurring is identified in this chapter. The management of flood risk is assessed through indicators on sea level change (including data on closures of the Thames Barrier) and the number of flood warnings issued, against possible tidal or fluvial flooding.

There is currently no indicator in this report on the number of properties affected by flooding in London. The data will be sourced from a project that aims to bring together data from a range of organisations including the Environment Agency, local authorities and the fire brigade, to provide a comprehensive assessment of properties affected. This data will be included in future reports.

A case study on the Drain London project is presented at the end of the chapter.

Indicator 3: Properties at risk of flooding

This indicator is a measure of the number of properties in London that are at risk of flooding from rivers, the sea or surface water, focusing on those with a significant likelihood of flooding. The high density of housing in the capital and the amount of development in the floodplain means London has a large number of properties at risk of flooding. Seven London boroughs[1] are within the top 20 local authorities in England and Wales with the highest number of properties at risk. However, for the majority the risk is tidal flooding, so the likelihood is considered to be low due to protection from the Thames Barrier and other tidal defences.

Properties with a significant likelihood of flooding are predominantly in the fluvial floodplain; generally not as well defended as the tidal floodplain. As schemes are implemented to defend this floodplain, the number of properties with significant likelihood of flooding is expected to fall.

The data used for this indicator is taken from the Environment Agency's National Flood Risk Assessment (Nafra) 2012. It considers the area of floodplain and likelihood of flooding from rivers and the tidal Thames, taking into account protection from defences and likelihood of these failing or being overtopped. Nafra uses 3 categories to assess likelihood.

Table 2: Likelihood categories

Risk	Likelihood
Low	1 in 200 chance (or less) of a flood happening in any one year
Moderate	1 in 75 to 1 in 200 chance of a flood happening in any one year
Significant	1 in 75 chance (or more) of a flood happening in any one year

The Nafra 2012 dataset provides a snapshot of the current situation and is not comparable with previous releases due to changes in the datasets used to calculate the figures. For this reason, there are no trends presented in this indicator. The data is modelled so the figures provided have been rounded to the nearest thousand.

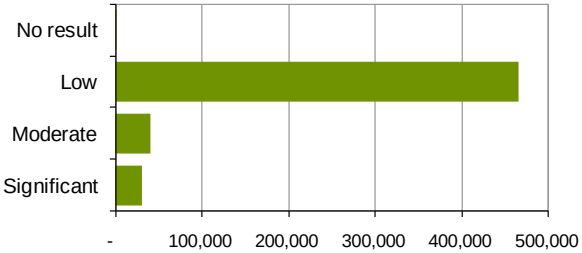
Analysis

- Just over 536,000 properties and almost 1.1 million people are at risk of flooding from rivers or the sea[ix]
- Around 80,000 properties are at risk of deep (>0.5m) surface water flooding[x].

6% of properties are in areas of London that have a significant likelihood of flooding.

- 87% of the properties at risk have a low likelihood of flooding due to defences e.g. the Thames Barrier (Figure 3).
- The London boroughs of Richmond upon Thames and Waltham Forest have the highest number of properties in areas with significant likelihood. They are ranked 29 and 43, of the top 50 local authorities nationally.
- Between 2007/08 and 2011/12, around 78,000 properties in the capital benefited from a reduced flood risk as schemes to improve and maintain defences were completed. A further 3,364 are planned for 2012/13.
- The number of properties benefiting increased from around 8,500 in 2007/08 to around 18,500 in 2011/12.

Figure 3
Properties in areas at risk of flooding, from rivers and the sea
No. of properties



Source: National Flood Risk Assessment (Nafra), Environment Agency 2012

[1] *These are Southwark, Hammersmith and Fulham, Newham, Wandsworth, Tower Hamlets, Westminster and Greenwich.*

Indicator 4: Sea level change

This indicator is a measure of the change in sea level at Southend-on-Sea, in the Thames Estuary. Climate change is likely to increase mean sea levels, increase peak surge tide levels and increased wave heights. Rising sea level has the potential to increase flood risk. In London this is being managed through the Thames Estuary 2100 project.

The Environment Agency's TE2100 strategy looks at how tidal flood risk will be affected by changes in climate and development in the floodplain. The main findings of TE2100 are that London's tidal defences, including the Thames Barrier, will continue to protect London from tidal flooding up until 2070 as plans are put in place to adapt to future climate change.

London is currently defended from tidal flooding by nine tidal barriers, including the Thames Barrier, and a network of flood walls and embankments. The Thames Barrier is also used to protect London from fluvial flooding; preventing the tide from passing through the Barrier during periods of high flows over Teddington Weir.

This indicator uses data from the Port of London Authority to assess change in sea level at Southend-on-Sea (Essex). This has been changed since the last report as the site in Sheerness is no longer in use. Sea level change is measured by looking at the mean tide level (MTL) in relation to the 'Ordnance datum Newlyn' (ODN) - the mean sea level at Newlyn, Cornwall, between 1915 and 1921. Once this was calculated, the mean was set as zero across the whole country and change is measured against it.

Trends are determined over the data period (1929 to 2011), rather than directly to the report baseline of 2000, to provide a clearer picture of change over time.

The indicator is also a measure of Thames Barrier closures. There are a number of factors that affect the frequency of Thames Barrier closures; it is not solely due to sea level change. This data is taken from the Environment Agency and begins in 1983, the first year of data available.

Analysis

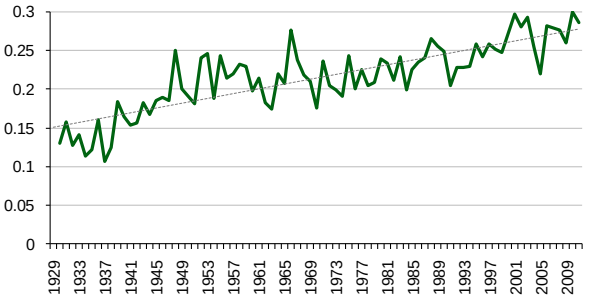
- Between 1929 and 2011, mean tide levels in Southend have risen by an average of 0.22 metres, and 0.28 metres since 2000 (Figure 4).

- The Thames Barrier has been closed 119 times since it became operational in 1982; 76 tidal closures and 41 fluvial closures (Figure 5).

Mean tide levels in Southend are rising in relation to the ODN.

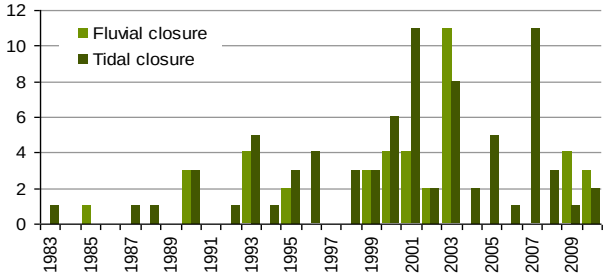
- Closures of the Barrier have become more frequent; two thirds of all closures have occurred since 2000. However, there are consecutive closures on successive tides, rather than individual events, which may affect the trend. This is particularly evident in 2000, 2001, 2003 and 2007.

Figure 4
Mean tide levels in Southend, 1929-2011
Metres



Source: Port of London Authority (PLO), 2012

Figure 5
Closures of the Thames Barrier in London
Number of closures



Source: Environment Agency, 2010

Indicator 5: Flood warnings issued

Improving awareness of flood risk and ensuring we are prepared for flooding is fundamental to reducing the consequences of a flood when it does occur. This indicator is a measure of the change in the type and frequency of warnings issued for flooding in London, on an annual basis. The term warning is used in this indicator to refer to all types of warning codes unless specified.

There are three stages in the Environment Agency's flood warning service – Flood Alert, Flood Warning and Severe Flood Warning. A 'Warnings no longer in force' message is issued to inform people who have received a warning that the situation is improving. The flood warning codes were changed in November 2010. The new codes are defined in table 3.

Table 3: Definitions of flood warning codes

Flood Alert	Flooding is possible. Be prepared.
Flood Warning	Flooding is expected. Immediate action is required.
Severe Flood Warning	Severe flooding. Danger to life.
Warnings no longer in force	No further flooding is currently expected in your area.

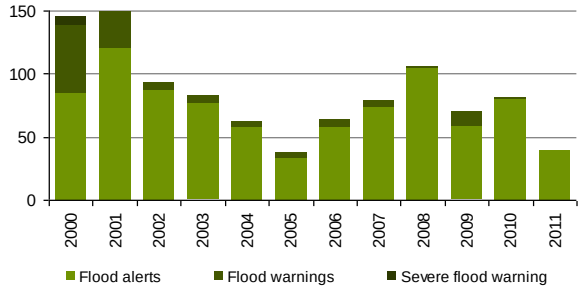
This indicator uses data on the number of each type of warning issued in London. Data are collated on an annual basis; therefore comparison with 2000 is available. Trends in warnings issued are indicative only as they are affected by changing rainfall patterns.

Analysis

- The total number of warnings issued has varied annually since 2000, with a decreasing trend between 2001 and 2005, from 150 to 37. Since 2005 the number of warnings issued has fluctuated around 70, except for a peak of 117 in 2008 (Figure 6).
- Flood Alerts make up the majority of warnings issued each year, making up 87% of all warnings since 2000.
- No Severe Flood Warnings have been issued in London since the 7 issued in 2000.

Fewer Flood warnings were issued in 2011 compared to 2000.

Figure 6
All flood warnings issued in London, 2000 to 2011
Number issued



Source: Environment Agency, 2012

Local case study

Drain London

Following publication of the draft Flood Risk Appraisal and the severe surface flooding in several parts of the UK, during summer 2007, it was clear that the threat from surface water flooding was poorly understood in London. Furthermore, there was a lack of consistent record keeping and unclear divisions of responsibility between numerous drainage asset managers.

The GLA, Environment Agency, Thames Water and London Councils set up the Drain London partnership. Defra has funded the partnership to deliver a series of 33 Surface Water Management Plans, one for each London Borough, and implement demonstration solutions to a range of surface water risks. During the project, the government introduced the Flood and Water Management Act 2010, which has placed additional requirements and responsibilities on London Boroughs as Lead Local Flood Authorities. The Drain London project outputs have been adjusted to assist boroughs with their new roles.

An important part of the project is the improved communication and partnership between the neighbouring boroughs, and between boroughs and the regional agencies that set up the project. The Drain London Forum has been successful in stimulating this partnership working and in sharing ideas. It is now working towards establishing a web-based portal to enable efficient sharing of data.

The project is currently mid-way through its programme. When complete it will represent a step change in the understanding of surface water flood risk, with a programme of management measures over coming years and demonstrations of how some more innovative ideas can be implemented.

The main outputs from the project will be:

- 33 Surface Water Management Plans, including flood risk and hazard mapping, and risk management proposals;
- 33 Preliminary flood risk appraisals;
- a London wide overview of flood risk to feed into a review of the Regional Flood Risk Appraisal;
- a fund to deliver green roofs in areas of known high surface water flood risk and a fund to help building owners survey options for green roofs;
- delivery of a demonstration Community Flood Plans to help at risk communities prepare for, manage and recover from a future flood;
- Detailed investigation and mitigation of some high risk flood areas.

This programme is part of an ongoing theme of increasing the priority of addressing flood risk and will lead to further work over the coming years. It is closely linked to implementation of the London Plan policy 4A.14 and draft Replacement London Plan policy 5.13.

Surface water flooding in London following heavy rainfall on 20 July 2007.
Source: Environment Agency

Useful links and further reading

- Thames Estuary 2100
- London Regional Flood Risk Appraisal
- Drain London
- London Plan 2011. Policy 5.12 (flood risk management)
- Thames Catchment Flood Management Plan (page 26). December 2009
- The River Restoration Centre – details restoration projects that have occurred or are planned in London, including those with flood risk benefits.

Old Ford Lock, River Le Navigation. Source: Pete Rudd, Environment Agency

3

WATER QUALITY IN LONDON

One of London's 47 river water bodies meets 'good ecological status' under the Water Framework Directive; 30 are classed as 'moderate' and 16 are 'poor'.

Around 39 million tonnes of dilute but untreated sewage is discharged annually into the Thames Tideway. This causes dissolved oxygen levels to drop below threshold levels on average around 52 days per year, requiring remedial action.

Serious water pollution incidents have fallen by 69% between 2002 and 2011. There are around 2 major incidents in London each year and occurrences' of significant incidents are also declining.

The quality of London's water environment is vital to people and wildlife in the capital. The River Thames and its tributaries provide habitat for a wide range of species, recreation opportunities, and drinking water for public supply.

The biggest pressures on the water environment are from diffuse and point source pollution, changes to the river channel, and the flow and volume of water available to dilute any pollution entering the river. Addressing the sources of pollution that adversely affect the state of London's water environment will help to protect and improve London's water quality. This includes misconnections of sewer to surface water drains, contaminated urban run-off and discharges of storm sewage.

There are 57 storm sewage discharges and combined sewer overflows (CSOs) going into the tidal Thames.

These result in untreated sewage entering the tidal sections and some freshwater tributaries, such as the River Lee, after rainfall. These overflows are a legacy from the 1800s when Joseph Bazelgette designed a sewerage network for London in place of the permanent disposal of sewage directly into the river. This network was designed to deal with both surface water drainage and foul water (sewage), as a combined system, with the facility to overflow into the Thames when the sewers reached their capacity. At the time, this resulted in significant improvements in river quality, even though there were intermittent discharges of foul water. However, the increase in population and development in the capital has put pressure on this network and its ability to cope with heavy rainfall.

We have chosen three indicators to illustrate water quality in London, looking at both freshwater and estuarine quality. For freshwater quality, the indicator is a measure of the ecological status of London's water bodies. This is based on criteria used to assess compliance with the EU Water Framework Directive. The water quality of the Thames Estuary is represented using data on dissolved oxygen levels – the number of days below threshold levels and the frequency of use of oxygenating vessels to improve quality. We have also looked at data on water pollution incidents in London, focusing on those with major and significant impacts to the state of the water environment.

Case studies highlighting projects and schemes that demonstrate improvements to water quality, in London, are presented at the end of the chapter.

Indicator 6: Freshwater quality – Ecological status

Ecological status is determined using criteria to assess compliance with the EU Water Framework Directive. It applies to all surface water bodies, including lakes, rivers, estuaries, coastal waters and artificial waters such as canals and also applies to groundwater. For the purpose of this indicator we have focused on the status of river water bodies in London. Ecological status is determined using a range of biological, chemical and physical qualities of a water body.

The main objectives of the EU Water Framework Directive are to prevent deterioration in the status of water bodies and to protect, enhance and restore them The key concept underpinning the Directive is adopting a holistic view of river basin management and a series of measures and actions have been set in order to achieve good ecological status or potential for London's water bodies. These will be co-delivered by a range of organisations across London. An example of a project being driven by the Water Framework Directive, to improve the Mayes Brook, is shown in the chapter case studies.

Status classification is based on a 2009 baseline, published in the first River Basin Management Plan (December 2009). This covers the period 2009 to 2015. Analysis against the report baseline of 2000 is therefore not available for this indicator. The next formal classification will be against the 2015 targets and reported in the second River Basin Management Plan. We will assess progress with these targets when this data are published.

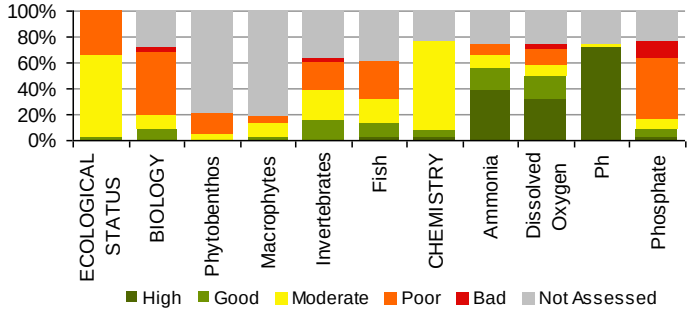
Analysis

- There are 47 designated river water bodies with all or part of their river length in Greater London[xi]. Figure 7 shows, of these:
  - One has 'good ecological status' and currently meets the requirements of the Directive. This is the Small River Lee (and tributaries) on the northern border of London.
  - 30 are currently assessed as moderate.
  - 16 are currently assessed as poor.

- The freshwater section of the River Thames, from Egham to Teddington, is classified as poor. The biology of the river is affecting the status achieved.

- Both sections of the Tidal Thames in London (from Teddington to Battersea, and Battersea to Mucking) are classified as moderate.

Figure 7
Status of London's river water bodies
Percentage



Source: Environment Agency, River Basin Management Plan 2009.

Indicator 7: Estuarine water quality – Dissolved oxygen levels

In the early 1950s long stretches of the Thames Tideway had no aquatic life and the river was classed as biologically dead as pollution reduced oxygen levels in the water. Major investment in sewage treatment in the 1960s and 1970s, along with a reduction in industrial inputs into the river, improved water quality and aquatic life began to return.

Dissolved oxygen (DO) is the most important indicator of the status of water quality in the Thames Tideway. It is affected by a number of factors including organic pollution (e.g. discharges of storm sewage), reduced freshwater flow, and temperature. These can reduce DO levels, reducing the quality of the estuary and its ability to support fish and invertebrates.

The Environment Agency has derived DO thresholds for management of the upper and middle sections of the estuary. For the upper estuary the threshold is 40% saturation, and for the middle estuary it is 30% saturation. These are considered the thresholds at which a detrimental impact is likely to be observed on tideway aquatic life, particularly fish. If DO saturation is below these thresholds, remedial measures are put into action.

The Environment Agency has a network of automatic water quality monitoring stations (AQMS) along the Thames Tideway which measure DO. AQMS feed live information on water quality, enabling a rapid response when water quality problems arise. This allows an accurate and timely assessment of water quality. Remedial measures include using Thames Water's oxygenation vessels, dosing hydrogen peroxide, reducing upstream abstraction rates to increase freshwater flows, and improving effluent quality from the large tideway sewage works during the summer months when the estuary is most sensitive.

This indicator uses the DO thresholds outlined above, along with the data from the AQMS, to determine the number of days DO is below standard in the Thames Tideway, and therefore having an impact on the state of the water environment. We have also assessed the number of days oxygenation vessels – the Thames Bubbler and Vitality - were deployed. Data are available from 2000 for both datasets used in this indicator so comparison has been made to the report baseline.

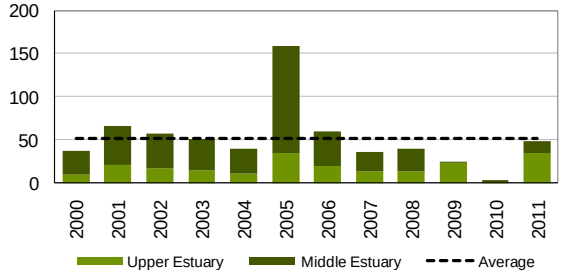
Analysis

- Storm sewage discharges into the Thames Tideway are directly linked to rainfall. The relative proportions of discharges from CSOs and sewage treatment works depends on where in the sewerage catchment the rain falls.

39 million tonnes of storm sewage is discharged into the Thames Tideway each year.

- Since 2000, DO saturation has been below standard on average around 52 days per year[xii] (Figure 8).
- The deployment of the oxygenation vessels shows a similar trend to that in Figure 8, demonstrating the number of times remedial action is required. Between 2000 and 2011, the average deployment is 33 times annually.
- Under the WFD, the DO status for the upper and lower sections of the estuary is good and high, respectively. The middle section, from Battersea to Mucking, is classified as moderate.

Figure 8
Days oxygen saturation is below standard in the Thames Tideway.
Number of days



Source: Environment Agency, 2012

Indicator 8: Serious water pollution incidents

Water pollution incidents can have a detrimental impact on the water environment. This indicator measures the number of recorded water pollution incidents that have a serious detrimental impact on the state of the water environment.

Common pollutants which cause water pollution incidents include: oil, fuels, organic pollutants (including crude and storm sewage), contaminated water (fire fighting run-off), chemical and pesticides. These pollutants can enter the water environment as a result of illegal or unauthorised discharges, accidental spillages, misconnections, containment and control failures, and sewer failures or overflows.

The Environment Agency is responsible for pollution control of all inland freshwaters and has a duty to respond to as many pollution incidents as possible, and act to contain the pollution and protect the water environment. Many other organisations have responsibilities for pollution incidents including water companies, local authorities and private landowners.

Each incident is given a classification based on the level of environmental impact. The classification ranges from category one, which are major incidents, to category four, which have little or no environmental impact. For this indicator, serious water pollution incidents are those classified as category one or two incidents and is referred to as major or significant incidents.

The first series of data recorded begins in 2002, therefore comparison to the baseline of 2000 is not possible for this indicator but trends will be drawn for the period available.

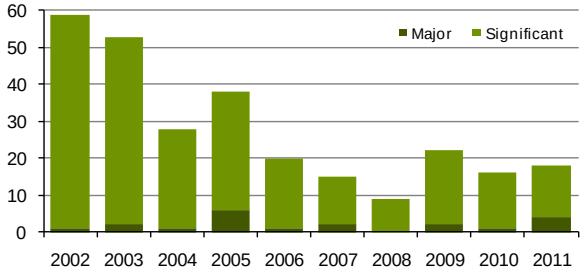
Analysis

- Serious water pollution incidents are low in London, with an average of two per year. In 2011, four major incidents and 14 significant incidents were recorded.
- Occurrences of serious incidents in London have fallen by 69% since 2002.
- Since 2002, the main cause of major pollution incidents in London has been authorised discharges of storm sewage following periods of heavy rainfall. Whilst these are undesirable, they are authorised under certain circumstances to prevent sewage backing up into homes and streets. Improvements are planned to improve this unsatisfactory situation.

The number of serious incidents recorded in London has fallen by 69% between 2002 and 2011, from 59 to 18.

- There has been an overall reduction in the number of significant incidents in London, since 2002, although notable increases are evident in 2005, 2009 and 2011.
- Reported reasons for these incidents range from natural events including algae and the weather, to containment and control failures, accidental spillages or illegal activities and discharges. The most common cause in 2011 was containment and control failures.

Figure 9
Serious water pollution incidents in London (2002- 2011)
Number of incidents



Source: Environment Agency, 2012

Local case study

Water Framework Directive: Mayes Brook restoration

The project aims to improve water quality in the channel, create an area of floodplain wetland to improve biodiversity and flood storage capacity. These improvements will help the brook become more resilient to climate changes, improve the amenity value of the natural environment, and help increase resident's engagement with nature.

Historically, Mayes Brook has been realigned and flowed through a deep concrete-lined channel. The water quality deteriorated due to urban run-off and misconnections. In the 1980s the brook was fenced off from the surrounding Mayesbrook Park. Work has been carried out to improve this stretch of Mayes Brook and the surrounding Mayesbrook Park to rejuvenate it for people and wildlife.

Environmental benefits from this project include:

- Restoration of around 800 metres of the Mayes Brook river channel
- De-channelising the Brook and returning to a natural channel, slowing down high flows and reducing flood risk
- Introduction of swales and reed beds to intercept and act as natural filters to reduce contaminants entering the brook
- Creation of in-stream and riverside habitat
- Creation of new wetland ponds and backwaters, increasing habitat diversity
- New riverside woodland and acid grassland in the park, providing new habitat for BAP bird species and shading for people and wildlife in the summer

Mayes Brook following restoration
Source: Mayesbrook Park: A park adapted to climate change (2012)

As part of this partnership project, Thames Water have identified misconnections at over 400 properties equating to over 850 appliances which have been discharging directly into Mayes Brook. The most common type of misconnection was the washing machine – over 250 were identified as misconnected to the surface water system on this catchment.

The restoration of Mayesbrook Park is a flagship restoration project under the London River's Action Plan. Another driver for improving Mayes Brook is the Water Framework Directive. It has been classified as a heavily modified water body, currently classified as moderate. Improvements are in line with measures in the River Basin Management Plan, to help improve the quality of this water body.

Local case study

Thames Tideway: Water quality improvements

Much of London has a combined drainage system, which carries both surface water and wastewater. This combined drainage system can be overwhelmed by as little as 2mm of rainfall, resulting in discharges of storm sewage to watercourses via overflows. On average 39 million cubic metres of dilute but untreated storm sewage is discharged into the Tideway each year from CSOs. These discharges can cause severe drops in oxygen levels, killing fish. Furthermore, sewage-derived litter deposited in the river and on the foreshore is polluting and unpleasant to see.

The proposed solution to this situation is to construct two tunnels to intercept flows from the identified unsatisfactory CSOs and upgrade existing tideway sewage treatment works (STWs).

- The proposed **Thames Tunnel** is being designed to capture flows from 34 unsatisfactory CSOs along the tideway for treatment at Beckton Sewage Treatment Works (STW). The proposed 20-mile (32km) Thames Tunnel will run from west to east London, beneath the River Thames. Its precise route has still to be determined. The target date for the submission of the planning application is late 2011. Initial construction of the Thames Tunnel is provisionally scheduled to start in 2012/13 and finish in 2020.

- The **Lee Tunnel** will prevent storm sewage from overflowing into the River Lee, a tributary of the River Thames. The tunnel will capture sewage from a single overflow point at Abbey Mills Pumping Station. Work began in spring 2010 and is due to be complete in 2014.

- **The Tideway STWs will be upgraded; these** include Beckton, Crossness, Mogden, Long Reach and Riverside. These improvements will provide additional treatment to improve effluent quality to meet Tideway water quality standards. These improvements will enable the site to deal with the increased sewage resulting from population growth until 2021. It will significantly reduce the amount of storm sewage that overflows into the Thames Tideway during heavy rainfall, when the STW becomes overloaded.

Discharge from the Abbey Mills pumping station into the River Lee.
Source: Environment Agency

Useful links and further reading

- River Basin Management Plan
- London Plan 2011. Policy 5.14 (water quality and sewerage infrastructure)
- The Thames Tideway Strategic Study
- Thames Tunnel 'Needs Report'. Thames Water. 2010.
- The Mayor's draft Water Strategy (April 2009)

Teddington Weir, Richmond upon Thames. Source: Environment Agency

4

WATER RESOURCES IN LONDON

At home, Londoners consumer around 164 litres of water per person per day (l/h/d), which is 20 l/h/d higher than the England and Wales average, but around 4 l/h/d lower than consumption in 2000.

The volume of water lost through leaking water mains (per property per day) has been reduced by 11% since 2000/01, but remains the highest in England and Wales at around 167 litres.

Flow in London's rivers supports good ecology all the time, except for the middle and lower sections of the River Lee.

Management of groundwater levels in recent years has meant levels in London are beginning to stabilise. However, levels have risen in west London by around 6 metres since 2000. Levels in central, east and parts of south London have fallen since 2000.

The availability of water resources in London depends on the balance between the amount of water taken for supply and the demand we put on the resources. About three-quarters of London's water supply comes from the rivers, primarily the River Thames and the River Lee. Groundwater directly supplies about a quarter of London's water, and more indirectly by supplying about 60% of river flow.

The South East of the UK receives less rainfall than many Mediterranean countries and this water has to be shared across a large population.

London has the most people living in the driest part of the country. In meeting our demand for water we are already taking more water out of the environment than it can sustain. 28% of homes in London currently have a water meter installed (2011/12) compared to an England and Wales average of 41%[xiii]. Metering and water efficient appliances can help reduce household demand and consumption of water. A case study on the RE:NEW project is presented at the end of the chapter.

During times of drought, low river flows or during periods of high demand, the Beckton Desalination Plant can provide additional supply to around one million people in London. As it is carbon intensive desalination is considered an 'emergency measure' and is not a long-term solution for future supply needs. We therefore need to manage the water we have to balance supply and demand.

The indicators chosen for this chapter provide an overview of the state of water resources in the capital. They consider what water is available, both in the rivers and groundwater, and how that water is both used and lost.

The first indicator in this chapter provides an indication of the changing demand on water resources, through data on the amount of water used in our homes, expressed as per capita consumption. To assess the amount of water lost from supply through pipes, we have presented an indicator on leakage.

The management of resources to ensure a balance between water for people and the environment is measured through an indicator on water resource availability. This uses data from Catchment Abstraction Management Strategies (CAMS) and also looks at flows in the River Thames from the hydrometric achieve. The final indicator in this chapter is a measure of the change in groundwater levels under London.

Indicator 9: Domestic water consumption

The amount of water we use in our homes is expressed as per capita consumption (pcc). This measures the average volume of water that each person uses every day. It is used by water companies to inform how they plan to maintain a balance between demand for water and their available supply over the next 25 years.

Thames Water covers the largest area of London, but the capital is also served by Affinity Water, Sutton and East Surrey Water, and Essex and Suffolk Water.

This indicator uses per capita consumption as a measure of water use since 2000. The figures used in this indicator have been calculated for London, based on water company data submitted to OFWAT for the water companies supplying London, and is proportioned for the Greater London area, rather than presenting figures for each water company individually. This provides an indication of London's water consumption.

Annual figures are available so comparisons have been made to the report baseline. In addition, the data are also assessed using five-year average periods. This is to smooth out annual fluctuations resulting from different weather patterns and subsequent drought or wet years. These average periods provide a clearer picture of patterns in household water use.

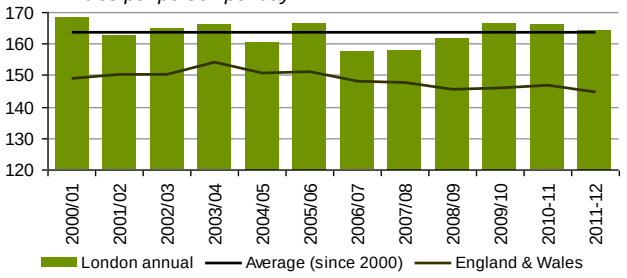
Analysis

- 74% of total water use is household use and 26% is non-household use.
- Domestic water use in London is around 164 litres per head per day (l/h/d).
- The per capita demand for water in our homes has fallen since 2000/01 (based on 5-year average use), but the latest figures (07/08 to 11/12) increased by 1.4 l/h/d compared to the previous period[xiv]. This is because the 2006 figures, which included the hosepipe ban, are no longer included.
- Annual water use, averaged across London, shows fluctuation over the last 12 years with current use (2011/12) 2% lower than in 2000/01. This is around 20 l/h/d more than the England and Wales average (figure 10).
  - Demand dropped in 2006 – this was a dry year with a hosepipe ban, reducing the amount of water people used.
  - 2007 and 2008 had lower use due to wet summers and less need for hosepipes.
  - Water use increased to higher than average levels in 2009. The summer was slightly drier increasing outdoor water use and water efficiency messages were less prominent in the media than in previous years.

London's domestic water use per person per day is higher than Paris (150 l/h/d) and Amsterdam (143 l/h/d)
www.eudeparis.fr and www.siemans.com

- The rate of household water use in London is currently 26% higher than the aspiration set out in Defra's Future Water Strategy, for households to consume on average 130 litres per person per day by 2030.

Figure 10
Domestic water use in London from 2000 to 2011
Litres per person per day



Source: Water company resource management plans

Indicator 10: Leakage in London

This indicator is a measure of the amount of water lost from leaking water mains and service pipes in London; known as 'leakage'. A large part of our water supply network was laid by the Victorians so they are now over 100 years old. Their age, combined with other factors, such as vibrations from road traffic and construction, weakens the pipes and joints, increasing the likelihood of leakage.

Leakage is not only a waste of natural resources (including wasting the energy used to abstract, treat and pump the water), but it also reduces the amount of water available for supply and the environment. The complex nature of the supply network means there will always be some level of leakage, but London is much higher than average.

Water companies are investing more and more to detect leaks and replace old pipes. For example, between April 2006 and March 2010, Thames Water invested £1126 million in reducing leakage and also aims to replace around 1,000km of water mains from 2010 to 2015. Opportunities to carry out this work have to be balanced against the implications for London's transport network (from digging up roads to access pipes) and the cost.

This indicator uses data on actual leakage levels (averaged for the London area), progress with leakage targets for water companies operating in London and the leakage rate per property per day. Data for this indicator is taken from Water Company's June Returns to OFWAT and is calculated for the London area using data from four water companies. Comparison with the report baseline of 2000 is available for this dataset.

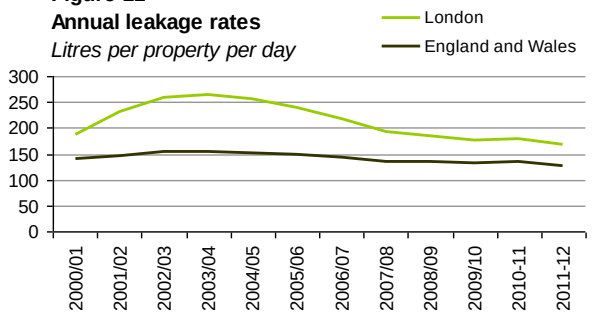
Analysis

- Actual leakage in London is around 5% lower than in 2000/01.
- A steady increase from 2000/01 to 2003/04 was evident. Following this peak, leakage declined from 853 to 562 mega litres per day (Ml/d).
- All the water companies operating in London have met their company-wide leakage targets since at least 2006/07, with the exception of Essex and Suffolk Water and Affinity Water whose leakage levels were slightly over their 2009/10 target.
- Current leakage rates for water companies operating in London range from 184 litres per property per day for Thames Water, to 84 for Sutton and East Surrey Water. This compares to a national average of 127.

Since the peak in 2003/04, London's leakage has reduced by over 105 Olympic swimming pools a day.

- Leakage per property per day in London as a whole is167 litres, compared to 187 litres in 2000/01 (Figure 11). Current levels are 37% less than the peak in 2003/04.
- Since 2000, the leakage rate per property per day in London has got closer to the England and Wales average, but is still around 32% higher. This is equivalent to an average of 40 litres per property per day in London.

Figure 11
Annual leakage rates
Litres per property per day



Source: Water Company water resource management plans

Indicator 11: Water resource availability

This indicator is a measure of the amount of water available to meet our demand and the needs of the environment. About three quarters of London's drinking water comes directly from the rivers Thames and Lee. Flow levels affect the amount of water available for the environment and supply.

Changes in rainfall patterns and increasing temperatures, as a result of climate change, are expected to affect river flows in future. The UK climate projections (2009) estimate that by the 2050s summer mean rainfall could decrease by between 14% and 19% (low to high emissions scenarios), whilst mean winter rainfall is projected to increase by 12% to 16%.

Computer modelling by the Environment Agency has shown that there is likely to be less water available in the summer as flows become lower. This will exacerbate any existing ecological problems in rivers and could put further pressure on meeting the objectives of the Water Framework Directive (WFD) because there would be less water in the river to dilute pollution.

This indicator uses CAMS and flow data to look at resource availability in London's rivers. CAMS measures resource availability against licensed abstraction to ensure there is a balance between the amount of water for the environment and that required for supply. It shows the percentage of time London's rivers meet environmental flow limits; the minimum amount of water required to protect and maintain a healthy ecosystem. Flow data is taken from the River Thames at Kingston. The site is used to control London's major public water supply abstractions and is taken from the Environment Agency hydrological archive.

Analysis

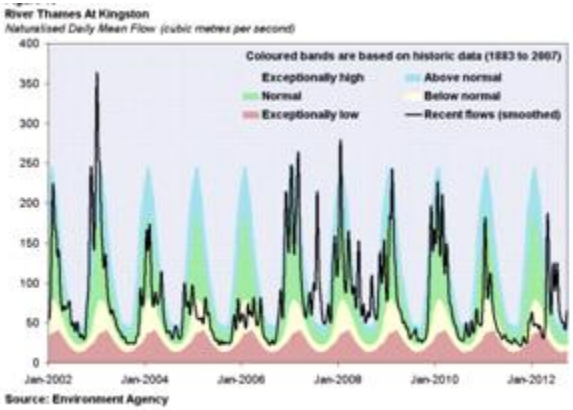
CAMS

- London's rivers have sufficient flow to support good ecology all year, except in the middle and lower River Lee.
- When looking at the volume of water actually abstracted from the river, the middle and lower sections of the River Lee only have resource available 46% and 25% of the time to support good ecology. These drops lower (26% and 11% respectively) for the maximum licensed abstraction volumes. Also, resource availability in the River Ravensbourne would drop to 73%.

Flows in the Thames at Kingston

Since 2000:

- There were significant winter flood peaks in 2000/01 and 2002/03 and exceptional summer flooding in July 2007 (which was the wettest on record since 1883). Flows in the River Thames at Kingston peaked at levels that would be considered "above normal" even in winter (Figure 12).
- There were concerns about drought in the dry periods between 2004 and 2006; and 2010 to 2012.



- The second drought was looking to be very serious, with exceptionally low flows following the very dry 2011/12 winter. This all changed however, after the wettest spring on record led to a dramatic recovery in river flow and groundwater levels across London and the South East.

Indicator 12: Groundwater under London

This indicator is a measure of the changing levels of groundwater under London. The chalk aquifer is the major groundwater supply source in London. The chalk is confined by overlying clays, which act as an impermeable layer preventing rainfall from replenishing the chalk groundwater levels.

Water levels in the chalk aquifer are maintained by groundwater flow into London from the Chilterns and North Downs. Management of groundwater levels is vital to ensure they are kept low enough to prevent flooding of London's underground infrastructure, whilst at the same time ensuring they are not lowered too far through unsustainable abstraction.

Heavy industry in London previously abstracted water from the ground to support their activities, peaking in the 1960s at 88 metres below sea level. As industry moved out of central London, ground water levels steadily recovered. However, by the 1990s rising levels began to cause concern.

The General Aquifer Research, Development and Investigation Team (GARDIT) developed a strategy to manage this by encouraging use of the aquifer for public water supply. Levels are currently still within the general parameters set by the GARDIT strategy but the situation is being monitored to ensure the required balance is achieved.

This indicator looks at levels of groundwater under London, using data from the Environment Agency's analysis of levels reported annually in the 'Management of the London Basin Chalk Aquifer'. The data are collected from London's network of observation boreholes, to monitor absolute levels and the rate of change.

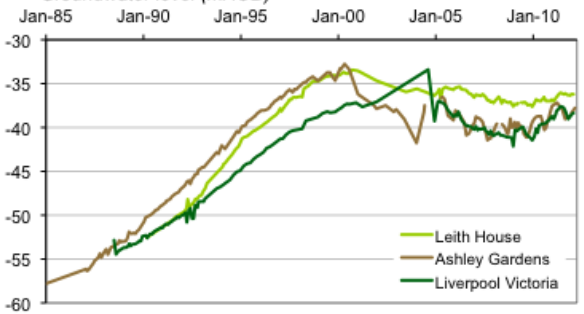
For this indicator we have shown data from 1985 to demonstrate the changing trend in groundwater levels over time, as the trend reversed in 2000. Groundwater levels are shown in metres above ordnance datum (mAOD) – this represents metres above the mean sea level.

Analysis

- Chalk groundwater levels are not uniform and will vary across the capital. These variations can result from the chalk's geology, actual abstraction rates and water level pressures from outside the area. These factors will have contributed towards changes in the water levels observed.

- In central London groundwater levels have fallen in the order of 3m since 2000, and up to 5m in east London as a result of increased abstraction[xv] (Figure 13).

Figure 13
Groundwater Hydrographs for Central London, 1985 to 2011
Groundwater level (mAOD)



Source: Environment Agency

- Groundwater levels in west London have continued to rise by around 6m since 2000, due to limited abstraction in this area. However, this has levelled off in recent years.

- Groundwater levels have fallen more than 3m across much of south London, with drawdown up to 6m concentrated around the many large public water supply abstractions.

Local case study

Improving water efficiency in London schools: the rainwater harvesting project

This project ran a small trial in 2011, which installed rainwater harvesting kit into four schools in London. This partnership project was led by the Greater London Authority, working with partner organisations including Thames Water, the Environment Agency and the London Sustainable Schools Forum.

Rainwater harvesting at Gainsborough Primary School (Hackney), March 2012. Source: Kingspan.

The aim of the trial was to reduce the amount of potable water that is currently used in school buildings to flush toilets and improve their water efficiency.

The four schools were retrofitted with systems to store rainwater gathered from the roof, which was then used to flush toilets and urinals. Along with fitting out of the harvesting and plumbing systems, an engagement programme was carried out. Specialists with a track record in working with students and teachers on environmental issues worked with each of the schools to explore water issues and embed good water behaviours within the school community.

This activity was followed up by a water audit and access to water consumption information, giving schools access to information that can help them change the way water is thought about and used.

Useful links and further reading

- The Mayor's draft Water Strategy (April 2009)

- London Plan 2011. Policy 5.15 (water use and supplies).

- Management of the London Basin Chalk Aquifer, Environment Agency 2010.

- Catchment Management Abstraction Strategies. Environment Agency.

- The Environment Agency's Water Resources Strategy for England and Wales and Regional Actions Plans

- Managing Abstraction. The Environment Agency, June 2010.

- The Energy Savings Trust

- Waterwise

- Defra's Future Water Strategy
- Thames Water: Water Resource Management Plan

Recycling plastic bottles. Source: Environment Agency

5 WASTE IN LONDON

The amount of household waste produced in London has declined by 12% since 2000, to 2.98 million tonnes in 2011/12. This equates to around 904kg per household.

Recycling and composting of household waste has increased from 9% in 2000/01 to 34% in 2011/12, but remains the lowest level in England.

There has been a 65% reduction in the amount of local authority collected waste sent to landfill in London over the last decade, from 3.2 million tonnes in 2000/01 to 1.1 million tonnes in 2011/12.

Waste arises from almost all activities and needs to be managed effectively to protect the environment and human health. Historically an increasing population and growing economy has generated greater quantities of waste. There are three main waste streams – local authority collected waste, waste collected and managed by the private sector (including commercial and industrial (C&I) waste and construction and demolition (C&D) waste).

In this chapter we have focused on local authority collected waste, primarily household waste, and have included data for other waste streams where available. We have not used the outputs from the commercial and industrial waste survey, carried out by Defra, because work is not complete on analysing the trends between the surveys done in 1998/99, 2003 and 2009/10. There is scope for this to be included in future reports.

In 2011/12 London produced approximately 3.65 million tonnes of local authority collected waste.

Waste activities can have a detrimental impact on the environment if not effectively managed. Resources are also being lost as materials that could be re-used, recycled or composted are being buried in landfill. The reliance on disposal to landfill can affect the quality of our land and increase greenhouse gas emissions from the breakdown of waste.

Reducing the amount of waste we produce, re-using and recycling more are fundamental to improve waste management and the state of the environment in London. In recent years less of London's local authority collected municipal waste has been produced, less sent to landfill and more recycled. This follows the waste hierarchy, found in the Waste Strategy for England.

Incineration falls between recycling and landfill disposal in this hierarchy. In London, the rate of incineration is influenced by capacity. Prior to the Belvedere Incinerator coming on line in 2012, there was no significant change in the rate of approximately 20%. The rate increased to 36% in 2011/12 and is expected to increase in future as this incinerator burns more of London's waste. The incinerators generate electricity from the burning of waste, but do not utilise the heat produced as an energy source.

We have used three indicators to address the production and disposal of waste in London. They measure reductions in the production of household waste, recycling levels and landfill. Data for these indicators has been sourced from Defra and the Environment Agency. The indicator on litter has been removed as the dataset is no longer collected. This topic is covered in the case study section. Re-use is a key priority but is not covered in the indicators due to limited data. We will monitor progress with this in future as more data becomes available. Case studies are presented at the end of the chapter.

Indicator 13: Household waste production

Household waste is an element of local authority collected waste, and covers all the waste produced in the home that is collected by the local authority through the regular collection service, civic amenity sites and recycling. This indicator is a measure of the amount of household waste produced in London.

Waste prevention is defined as 'minimising the quantity (weight and volume) and hazardousness of household-derived waste, generated in a defined community'[xvi]. This includes avoidance (not producing the waste in the first place), reduction and reuse of waste. The chapter case study looks at Wandsworth's 'less in your bin, more in your pocket' campaign.

In the UK we throw away around 8.3 million tonnes of food and drink each year, with around five million tonnes (60%) being avoidable food waste. This equates to around £480 for the average household[xvii].

This indicator uses data from the WasteDataFlow database, which holds information from each borough on their waste activities. The indicator uses data on London's total household waste and the calculated volume per household. Data are recorded annually (by financial year), so comparisons with the report baseline of 2000 have been made.

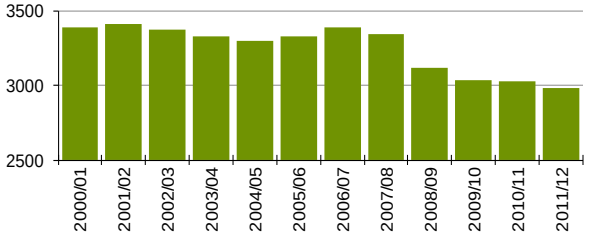
Analysis

- London produced 2.98 million tonnes of household waste in 2011/12[xviii], which is declining year on year (Figure 14).
- Household waste makes up around 82% of the total local authority collected waste in London, which is currently 3.6 million tonnes.
- The amount of household waste produced in London has declined by 12% since 2000/01, from 3.4 million to 2.98 million in 2011/12.
- Total household waste arisings per household are around 904kg (2011/12)[2]. There is a target in the Mayor's draft Municipal Waste Strategy to reduce this to 790kg per household by 2031.
- London produces less waste per household than any other region in England.

Despite a rising population in London, the production of household waste has fallen in recent years. This is due to behavioural change and in part reflects the recession of recent years

- Two London boroughs – Tower Hamlets and Lambeth - are in the top 10 local authorities with the lowest production of household waste per head in 2011/12.
- Since 2000, the total amount of household waste generated each year in England has decreased by 9%, while London's has decreased by 12%.

Figure 14
Total household waste arisings since 2000/01
Thousand tonnes



Source: Defra 2011

[2] *Calculated figure, based on Defra waste statistics and household figures in the 'Focus on London' housing chapter p5.*

Indicator 14: Recycling and composting

As waste is diverted away from landfill, more is being recycled and composted. Recycling and composting of waste forms the third tier of the waste hierarchy after prevention and reuse. This indicator looks at the rate of recycling and composting for all of London's local authority collected waste, and considers the household only component. It also addresses the recycling collection service available to households.

Targets to increase the amount of local authority collected waste that is recycled or composted are identified in the London Plan (KPI 19). The 2010 target to achieve at least 35% was not met; however plans are in place to meet the target of 45% by 2015.

Data for this indicator is taken from the WasteDataFlow database.

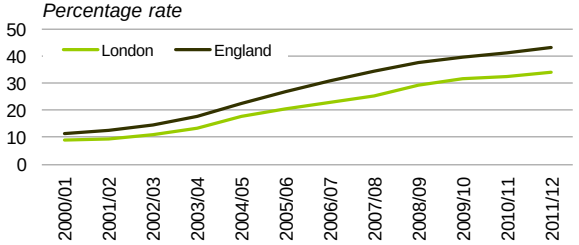
Analysis

- London's household recycling and composting rate has increased from 9% in 2000/01 to 34% in 2011/12 (figure 15).
- Recycling of dry materials across London accounts for approximately 24% of the household waste generated, whilst composting accounts for around 11% in 2011/12.
- Bexley and Bromley have the highest household recycling and composting rates in London at 54% and 50% respectively. In Bexley 24% comes from composting alone.
- The lowest rates are in Newham and Lewisham. However, Newham saw the 2nd largest improvement in England between 2010/11 and 2011/12. The rate increased from 15% to 23%, showing a 52% increase in one year.
- The average rate of recycling is similar for inner and outer London boroughs, at 23% and 24% respectively. However, rates vary by borough and therefore within the classifications of inner and outer London. Rates of recycling are affected by the density of housing, affluence, provision of services, space to store recyclables and behaviours.
- Outer London boroughs have an average composting rate of around 15%, but the rate of composting is much lower in Inner London at 4%. This is due to variation in the organic waste collection services and the presence of gardens.

Recycling and composting of London's local authority collected waste has increased from 8% in 2000/01 to 30% in 2011/12, but London continues to have the lowest rate in England.

- The percentage of London households that receive a recycling collection or have suitable access to recycling facilities has increased from 53% of properties in 2000/01 to 95% in 2006/07. However, it was recorded as 85% in 2007/08 and 2008/09 (BVPI 91a). *Figures for 2009/10 onwards are not available.*

Figure 15
Household recycling and composting rate in London since 2000/01
Percentage rate



Source: Defra 2012

Indicator 15: Landfill

This indicator is a measure of the change in the tonnage of London's waste disposed at landfill, from the main waste streams, along with data on the remaining capacity of London's landfill sites. Data for this indicator is taken from the WasteDataFlow database and the Environment Agency.

Disposing of waste to landfill is not sustainable – resources are being lost as materials that could be re-used or recycled are not being recovered. Around 6.3 million tonnes of London's waste went to landfill in 2011.

There are two main landfill sites in London for local authority collected waste – Beddington Farmlands and Rainham. Capacity at these sites is rapidly being exhausted and they are expected to close in 2021 and 2018 respectively[xix]. This means most of the capital's waste is transported and disposed of in other regions. This increases carbon emissions and costs, and these sites also have limited capacity.

The Landfill Allowances and Trading Scheme (LATS) began in April 2005 and set a limit on the amount of biodegradable municipal waste (BMW) any local authority can send to landfill. The Landfill Directive targets aim to achieve reductions on the 1995 BMW levels. These reduction targets were 25% by 2010 (or 1.7 million tonnes) and are 50% by 2013 and 65% by 2020[xx].

Landfill releases harmful greenhouse gases into the atmosphere, which damage the environment and contribute to climate change. London's local authority collected waste sent to landfill releases around 465,000 tonnes of CO_2 equivalent each year. Reducing the amount of waste produced and reducing the amount sent to landfill, could create a net saving of around 1.5 million tonnes of CO_2 equivalent each year[xxi].

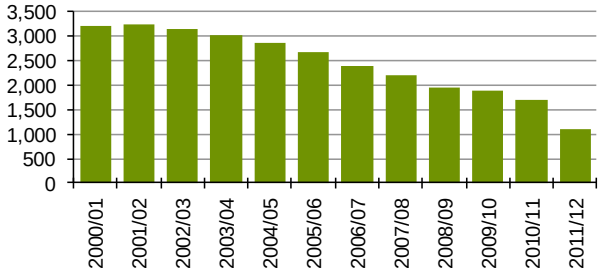
Analysis

- There has been a 65% reduction in the amount of local authority collected waste sent to landfill from London since 2000/01. It has reduced from 3.2 million tonnes to 1.1 million tonnes in 2011/12 (Figure 16).
- There is variability at borough level between the rates of landfill disposal. There has been a significant reduction in the amount of waste sent to landfill by the City of London, from 75% in 2010/11 to 21% in 2011/12, as more is sent to the Belvedere incinerator. Lewisham, Westminster, Greenwich landfill less than 10% (NI193 2011/12) as the majority of the waste is incinerated.

Landfill disposal accounts for 31% of London's local authority collected waste.

- Landfill capacity within London has decreased since 2000/01, from 20 million cubic metres to 9.7 million cubic metres in 2011[xxii].
- In 2010/11 London sent 1.2 million tonnes of biodegradable municipal waste (BMW) to landfill. This is 78% of the allocated volume of 1.55 million tonnes.

Figure 16
Tonnage of local authority collected waste sent to landfill in London
Thousand tonnes



Source: Defra 2012

Local case studies

Recycling and Composting: Flats recycling programme

The London Waste and Recycling Board's (LWARB) Flats recycling Programme was launched in July 2010, with a £5 million grant fund specifically for local authorities. The programme was established to help authorities overcome common barriers that affect recycling performance on flats and high-rise properties by funding new recycling collection infrastructure.

Flats and multi-occupancy buildings account for around 50% of all housing in London but at the time the programme was launched recycling collected from these properties was only around 10%, significantly lower than houses. The Mayor of London has made improving recycling in flats a key priority in his Municipal Waste Strategy. LWARB's funding was awarded in two rounds, to 29 projects across 26 boroughs that successfully bid for support to roll out new recycling services, as well as make improvements to existing services. This included:

- New food waste recycling facilities
- Underground recycling storage systems
- Reusable bags to help residents carry down recycling to bins on ground level
- Installing better, more accessible bins
- A recycling incentive scheme.

It is hoped that over the first four years, the LWARB funded flats projects will deliver improved recycling facilities to over 520,000 households, diverting around 75,000 tonnes of waste from landfill and will prevent almost 66,000 tonnes of CO_2 from entering the atmosphere.

All 29 funded projects are now operational and LWARB is currently preparing the Flats Recycling Programme report (due Q1 2013/14). The aim is to bring together the key outcomes and learning from the Programme, along with case studies to enable other authorities to develop their own schemes based on the good practice.

Examples of schemes include:

- Tower Hamlets – Both existing and new properties will benefit from improved recycling facilities including installation of new underground recycling containers and the conversion of underground refuse bins into recycling containers.
- Brent – LWARB will support Brent's aim to service all blocks of flats in the borough with recycling facilities. This will include the introduction of new mixed recycling facilities to over 12,000 properties and providing almost 30,000 households with reusable bags to carry recycling down to on site facilities.
- Merton – Merton will roll out of a new food waste recycling service to over 12,650 flats, made possible by new food waste facilities, supplying food waste recycling bins, food waste caddies and liners to residents.
- Southwark – Southwark will set up a Mobile Recycling Centre (MRC), allowing residents living in estates to recycle materials that are not currently accepted through the standard flats recycling service. The MRC will collect textiles, electrical goods and batteries. The vehicle will also have some capacity for wood and scrap metals.
- Bexley – A community and household incentive scheme called London Green Points, for flats, will run in the Thamesmead area to increase recycling, reuse, and drive waste minimisation. Along with this, the funding will be used to extend food waste collection services to 10,000 households living on estates by providing over 200 new on-site food waste bins, as well as a caddy and supply of compostable liners to residents to help residents get started using the new service.

Street Cleanliness: Capital Clean-up

The Capital Clean-up campaign has been ongoing since 2007, and led by the Mayor of London since 2011. The campaign is delivered in partnership with many organisations and community groups across the capital including Groundwork, the Environment Agency, Thames21, London Boroughs and the Met Police.

The campaign was originally set up to help make London cleaner, greener and safer before the London 2012 Olympics, through local action, education and enforcement. Since then, the campaign has shifted focus, aiming to inspire and enable London's residents to make the capital a nicer place to be through the continued improvement of community spaces.

The campaign also uses digital tools to help raise awareness and encourage participation. An interactive online map helps residents to identify clean-up events near them and contact organisers directly. Any London clean-up event can be registered and added to the event map. To help residents take action in their local areas, the website also provides information on how to plan and execute a local clean-up event. Events are also promoted via Twitter, Facebook and the Project Dirt profile.

Now into its 5th year, the scheme has coordinated over 1,000 clean-up events. Since last year, there has been around 400 events and over 5,000 volunteers.

Source: Greater London Authority 2012

In the run-up to the London Olympics, Capital Clean-up delivered over 25 sponsored, high profile, clean up activities. Between April and June 2012, the P&G Capital Clean-up had around 2,000 volunteers taking part across London. These events ranged from litter picks to canal side graffiti removal. These events were advertised online, on public transport and on the radio which resulted in record numbers of new volunteers for the campaign.

For more information on this campaign, visit www.london.gov.uk/capitalclean-up.

Useful links and further reading

- The Mayor's draft Municipal Waste Strategy
- London Plan 2011. Policy 5.16 (waste self-sufficiency) and 5.17 (waste capacity)
- The Waste Strategy for England
- Landfill Allowances Directive (LATS)
- Defra waste statistics
- Environment Agency waste data
- London Remade – waste efficiency

Bus and Bike in London. Source: Thinkstock.com

6

AIR QUALITY, TRANSPORT AND NOISE

The rate of improvement in levels of particulate matter (PM_{10}) has been slower in the last decade than in the 1990s. Similarly, levels of nitrogen dioxide (NO_2) in London fell until 2002, but have remained relatively stable since then.

The proportion of journeys on public transport increased from 34% in 2000 to 42% in 2010, compared to a drop from 43% to 36% for transport by private vehicles.

3.2 million people (42% of London's population) are exposed to a noise level of 55 decibels (dB) L_{den}, or more, from road traffic, and over 450,000 (6% of London's population) from railway noise.

Air quality is a public health issue and has impacts on the environment. Improving air quality in London is a priority. It is clear that long-term exposure to high concentrations of air pollutants (that is, exposure across the entire life span of an individual) can contribute to: shortening of life expectancy, the development of chronic diseases, and increase the risk of respiratory illness. Poor air quality can affect biodiversity, causing damage to roadside vegetation and in the long term, affecting growth and development of plants and trees, and species' diversity. The main pollutants are nitrogen dioxide (NO_2) and particulate matter (PM_{10}), with road transport being a major source. A case study on a trial to reduce air pollution in London is presented in this chapter.

Under the Local Air Quality Management framework set by the Government, the boroughs must regularly review and assess air quality and designate Air Quality Management Areas (AQMAs) where UK objectives are currently not being met. Where a Borough has declared an AQMA, an Air Quality Action Plan is required to be produced that works towards achievement of the air quality objectives. All 33 Boroughs have designated AQMAs.

The changing climate will have implications for air quality in London as it is affected by weather patterns. Increasing summer temperatures generally result in an increase in natural emissions of air pollutants such as methane, carbon dioxide and volatile organic compounds (VOCs), from wetlands and vegetation. Increased summer levels of ozone are expected with increasing temperatures, as seen in the heat wave of 2003; so increasing the likelihood of summer smog. Higher temperatures may increase energy demand from air conditioning use.

Public transport is becoming more popular; there has been a rise in low carbon alternatives to the private car.

Low carbon schemes include the Barclays Cycle Hire Scheme (presented as case study at the end of this chapter), hydrogen buses and electric vehicles. Transport for London is introducing eight new hydrogen buses in London which emit only water vapour; there are no CO_2 or particulate emissions from the exhaust.

Noise (unwanted sound) can affect health and quality of life by causing disturbance, disrupted sleep and stress-related heath effects. Noise can be reduced through better management of transport systems, better town planning and building design.

This chapter uses three indicators to analyse trends in air quality, transport and ambient noise in London. We have chosen to look at data on: the concentration of main air pollutants; changing transport patterns and the use of public transport; and exposure to excess aviation, rail and road transport noise (ambient noise).

Indicator 16: Air pollutant concentrations

Air quality is monitored in London by the London Boroughs, Transport for London and Defra, with over 100 continuous monitoring sites contributing measurements to the London Air Quality Network (LAQN). These sites are in a range of locations to represent different pollutant exposures including road side, kerb side, urban background, suburban, rural and industrial.

Data used in this indictor is calculated by King's College London. It combines data from London's air quality monitoring sites to enable assessment of long-term trends for different sites types and pollutants. A trial to reduce air pollutants in some of London's most polluted areas is outlined in the chapter case study.

Legally binding limits and objectives for air pollutants are given in the EU ambient air quality directive, UK air quality strategy and the Mayor's air quality strategy. The EU annual mean limit values are 40 ug/m^3 for PM_{10} by 2011 and NO_2 by 2010. EU 24-hr PM_{10} mean limit value is 50 ug/m^3 by 2011 and 1-hr NO_2 mean limit value is 200 ug/m^3 by 2010.

Analysis

- The measurement method for PM_{10} changed in 2004, which has affected the long-term assessment. Since 2004, concentrations of PM_{10} have exhibited annual variations due to yearly weather changes but overall concentrations remain stable. Improvements seen in 2009 and 2010 were offset by increases in 2011.

- Concentrations monitored across London indicate the EU limit value for annual mean PM_{10} (40µg/m^3) has been consistently met since 2000 at the majority of monitoring sites in the London network[xxiii].

- However, the limit value for daily mean PM_{10} concentration has been exceeded at a small number of sites in London. The causes of exceedences vary by site and include both industrial sources and traffic.

- NO_x concentrations have continued to reduce over time but NO_2 concentrations have levelled off, although there have been some reductions since 2009.

- The EU limit value for annual mean NO_2 (40µg/m^3) has been consistently met since 2000 at urban background monitoring locations in outer London.

- Urban background concentrations of NO_2 in inner London, and at roadside locations, have exceeded the annual limit value since 2000. Concentrations close to busy roads can be 2-3 times the limit value but similar problems are seen in many EU cities. Measures, identified in the Mayor's air quality strategy, are being taken to reduce levels to meet the limit value.

Figure 17
Annual mean concentrations of NO2 at sites in London, 2000 to 2011

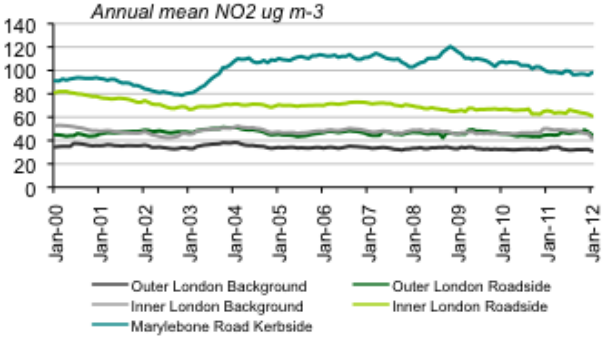
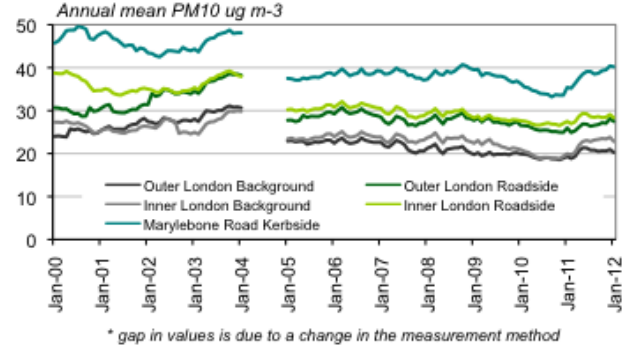


Figure 18
Annual mean concentrations of PM10 at sites in London, 2000 to 2011



** gap in values is due to a change in the measurement method*

Indicator 17: Road traffic and public transport

Reducing the use of private cars, and increasing the use of public transport, in the capital helps improve air quality and the state of the local environment by reducing emissions of PM_{10} and NO_2 associated with transport.

London has seen a growth in the demand for travel over the last decade, due to population and employment growth. Daily trips have increased by 2.2 million (or 9.4%) since 2000, from 22.6 million to 24.8 million. However, there has been a shift away from use of private transport towards more sustainable public transport[xxiv]. Changes to transport policy, transport networks, and transport operational practice over the last decade have contributed towards the increasing use of public transport. The congestion charge in central London and the London Low Emissions Zone, have helped reduce the volume of traffic and the emissions from some transport sectors.

The data for this indicator is taken from the Transport for London (TfL) annual 'Travel in London' report. The data shows road traffic levels, the number of daily trips (by main mode of transport), and the share in mode of transport at the journey stage level, and transport related carbon dioxide emissions. Targets are set in the Mayor's Transport Strategy and in the London Plan (KPI 13) to see the use of public transport increase faster than use of the private car.

Analysis

Road traffic levels have shown an overall reduction since 2000[xxv] (Figure 19).

- Traffic from all motor vehicles has fallen from 32.5 billion kilometres to 30.3 billion kilometres in 2010.
- Particular declines are seen in central and inner London since 2000, with traffic from all motor vehicles falling by 23% and 10% respectively.
- Road traffic in London has reduced by around 7% between 2000 and 2010, with the greatest change being on minor roads.

Looking at the main modes of transport (at the journey stage): [xxvi]

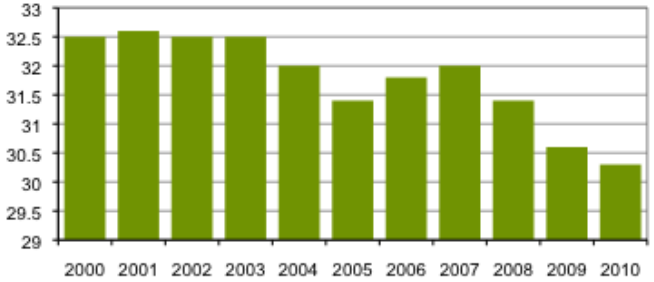
- Public transport increased from 34% in 2000, to 42% in 2010 (Figure 20).
- Private transport, including car and motor cycle use, has reduced from 43% in 2000 to 36% in 2012.
- Cycling increased from 1% to 2%.

Emissions of CO_2 from ground-based transport were 9.39 million tonnes in 2010 having fallen by 2% since 2009.

- CO_2 emissions from road transport, diesel rail and shipping have reduced by 7% since 2003.
- Road traffic accounted for 82% (6.7 million tonnes) of the ground based transport total; 10% less than in 2003.

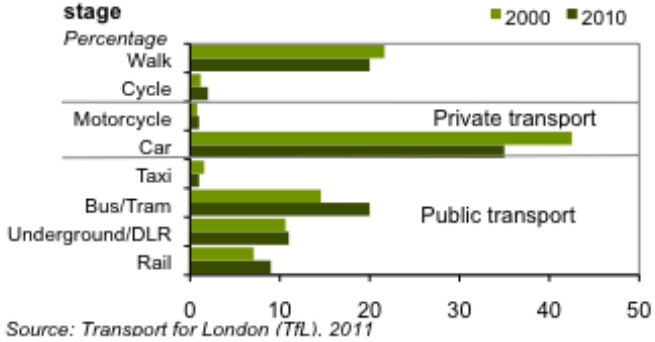
Despite an increase in the demand for travel since 2000, there has been a shift towards more sustainable travel; public transport increased by 24%

Figure 19
Total annual traffic for all motor vehicles
Billion vehicle kilometres per year



Source: Transport for London, 2011

Figure 20
Mode share for transport in London at the journey stage



Source: Transport for London (TfL), 2011

Indicator 18: Aviation, rail and road transport noise (ambient noise)

This indicator set provides a measure of the estimated exposure of the population within London to ambient noise from the transport system, including noise from aircraft using Heathrow and London City Airports, the operation of railways and from road traffic.

European law requires noise maps of the larger agglomerations in Europe to be produced every five years. In London the first 'round' of noise mapping was completed in 2007 and went online in 2008. The results of the noise mapping for the London agglomeration[3] can be viewed in full on the Defra website. The exercise complied with the Environmental Noise (England) Regulations 2006 and the resulting maps have informed the noise action plans. A second round of noise mapping.is expected to be completed by Defra for publication in 2013.

Amongst the various noises indexes used in noise action plans is L_{den} (level day evening night) which is a special European noise index relating to an annual average day in a given year.

[3] *The London agglomeration is defined by specific criteria and as a result its extent is not precisely the same as that of the Greater London Authority.*

The Mayor's previous State of Environment Report for London included data for the numbers of people and dwellings exposed to various levels of road traffic noise. This data was drawn from a pilot study that was completed in 2004 and which preceded the END noise mapping exercise. Due to differences in methodology, however, it is not possible to make comparisons between the datasets.

National planning guidance (PPG 24, 1994) explained that in respect to air traffic 57 decibels (dB) is considered to relate to the 'onset of significant community annoyance'. It is also noted that World Health Organisation guidelines promote "general daytime outdoor noise" levels of less that 55 dB as desirable to prevent any significant community annoyance. This planning guidance has now been replaced by the National Planning Policy Framework published in March 2012.

Analysis

Roads and Railways

Using data from the first round of noise mapping by Defra, the numbers of people and dwellings affected by different levels of both road transport and railway noise in the London agglomeration are presented in the tables below.

Table 4: Estimated number of people and dwellings in London above various noise levels due to road traffic

Noise level	No. of dwellings	No. of people
≥55	1,417,000	3,246,000
≥60	965,000	2,182,000
≥65	582,000	1,296,000
≥70	191,000	413,000
≥75	14,000	29,000

Table 5: Estimated number of people and dwellings in London above various noise levels due to railways

Noise level	No. of dwellings	No. of people
≥55	200,000	453,000
≥60	119,000	269,000
≥65	54,000	120,000
≥70	14,000	29,000
≥75	1,000	2,000

- The estimated number of people exposed to a noise level of 55 decibels (dB)*, or more, due to road traffic (Table 4) accounts for around 42% of London's population. In comparison, the people exposed to 75 dB, or more, accounts for around 4%.
- The estimated number of people exposed to a noise level of 55 decibels (dB)*, or more, due to railways (Table 5) accounts for around 6% of the

London population. The number of people exposed to 75 dB, or more, is too low to register a percentage of the London population, for railway noise.

For roads, transport related noise is reported annually by Transport for London (TfL) using the following indicators:

- Pi1 (percentage of the Transport for London Route Network (TLRN) with lower noise surface material)
- Pi2 (percentage of buses in fleet at least 2dB quieter than the legal limit.

Table 5: Road noise indicators (TfL)

	2007 /08	2008 /09	2009 /10	2010 /11	2011 /12
Pi1	70	70	74	74	74
Pi2	18	14	28	37	54

Aviation

Data from the first round of noise mapping by Defra, using Lnight as well as Lden, for Heathrow and London City airports is presented in the tables below.

Table 6a: Heathrow - estimated number of people exposed to L_{den} bands

55-59	60-64	65-69	70-74	>74
561,500	140,300	44,600	8,900	700

Table 6b: Heathrow - estimated number of people exposed to L_{night} bands

55-59	60-64	65-69	70-74	>74
145,300	45,700	14,600	1,700	0

Further data for Heathrow Airport is set out in the airports new Noise Action Plan. This was approved by the Secretary of State in May 2011.

Table 7a: London City - estimated number of people exposed to L_{den} bands

55-59	60-64	65-69	70-74	>74
10,500	1,600	100	0	0

Table 7b: London City - estimated number of people exposed to L_{night} bands

55-59	60-64	65-69	70-74	>74
0	0	0	0	0

Table 7c: Estimated number of noise sensitive buildings above various noise levels (L_{den})

Noise level (dB)	Schools	Colleges	Hospitals
≥54	3	0	1
≥57	1	1	0
≥60	0	0	0
≥63	0	1	0
≥66	0	0	0

Table 7d: Estimated number of noise sensitive buildings above various noise levels ($L_{evening}$)

Noise level (dB)	Schools	Colleges	Hospitals
≥54	4	1	1
≥57	1	0	0
≥60	1	0	0
≥63	0	1	0
≥66	0	0	0

Further data for London City Airport is set out in its new Noise Action Plan. This was approved under the EU Noise Directive by the Secretary of State in May 2012.

Development of ambient noise indicators

In future updates, the second round of Defra noise mapping will be available, enabling a time series from this data to be presented. Scope to include data on 'quiet areas' will also be considered in response to recent European initiatives and relevant policies in the National Planning Policy Framework (2012). In addition, now that the first Noise Action Plans for Heathrow and London City airports have been approved, it is envisaged that future updates to this report will build on these plans and their data, to present a time-series that can be updated regularly.

Local case studies

Delivering a Cycling Revolution: Barclays Cycle Hire scheme

Cycling helps us tackle many of the issues facing London – issues like congestion, air quality and health inequality. The most visible change to London's transport network during the past year has been the introduction of the Barclay's Cycle Hire Scheme. The main aim of this scheme is to provide opportunity and access to cycling in the capital, creating a modal shift in transport. The blue bikes are quickly becoming a familiar part of our landscape.

By September 2012, 15 million hires had taken place since the launch of the scheme in July 2010 and the average number of weekday hires reached 30,000 per day. Following the eastward extension in March 2012, the scheme now covers 65km2 of the Capital. It has docking stations and hire bicycles available in Camden, City of London, Hackney, Islington, Lambeth, Kensington and Chelsea, Southwark, Tower Hamlets, Westminster, several of the Royal Parks and Canary Wharf.

In 2011, the Mayor asked TfL to prepare plans for a westward extension of the scheme into the boroughs of Wandsworth, Hammersmith and Fulham, Lambeth and Kensington and Chelsea. Since then TfL has been working with the boroughs to identify more than 200 suitable locations for docking stations and to develop the design and layout of the proposed expanded area. The extension to the west and the introduction of new docking stations within the existing area will increase the number of bicycles by 2,400, to around 11,000 and will deliver an additional 250,000 to 300,000 Barclays Cycle Hire journeys each month.

Barclays Cycle Hire Scheme
Source: Greater London Authority

Useful links and further reading

- The Mayor's Air Quality Strategy - Clearing the air
- The Air Quality Strategy for England, Scotland, Wales and Northern Ireland
- Air quality: London Plan 2011. Policy 7.14 (improving air quality)
- London Air Quality Network (LAQN)
- Defra air quality information pages
- Directive 2008/50/EC – Ambient air quality and cleaner air for Europe. European Commission, 2008.
- Health study report commissioned by the Mayor of London. Report on estimation of mortality impacts of particulate air pollution in London (June 2010)
- The Mayor's Transport Strategy
- Transport in London. Transport for London's Annual transport report (2010).
- Transport: London Plan 2011. Policies 6.1 to 6.13
- Noise: London Plan 2011. Policy 7.15 (reducing noise and enhancing soundscapes)
- Defra Noise Action Plan for the London agglomeration
- The Mayor's Ambient Noise Strategy (2004)

Red Deer Stag grazing in Richmond Park. Source: Paul Glendell, Natural England

7 BIODIVERSITY IN LONDON

Sites of Importance for Nature Conservation (SINCs) increased by around 1,500 hectares between 2001 and 2012 and now cover over 30,000 hectares of land in the capital. 93% of Sites of Special Scientific Interest (SSSI) are in favourable or recovering condition; an increase from 73% in 2000.

London's habitats are improving; around 39,000 hectares have been enhanced and 18,000 hectares restored and progress is being made towards delivery of some of the London Biodiversity Action Plan habitat targets.

Fish populations are generally improving in the tidal Thames; smelt populations have been relatively stable and salmon and eels have returned to the river.

Overall populations of a range of common bird species have increased by 15% since 2004, but some species have seen a decline.

London supports a wide range of biodiversity and habitats, including woodlands, parks, wetlands and marshes, and the River Thames and its tributaries – the largest continuous habitat in London. The capital boasts sites of local, national and international importance and in addition to its designated sites; In 2011 the Government published 'Biodiversity 2020: A Strategy for England's Wildlife and Ecosystem Services'. This sets out a new set of priorities to halt biodiversity loss, support healthy functioning ecosystems and establish coherent ecological networks, with more and better places for nature for the benefits of wildlife and people. London's biodiversity targets, as set out in 'The London Biodiversity Strategy' and 'The London Plan' will help to achieve Biodiversity 2020 outcomes.

Underpinning London's biodiversity is its geodiversity – its rocks, minerals, fossils, soils, landforms and natural processes. Seven of the 36 SSSIs in London are designated for their geological importance.

Biodiversity is under pressure from the increasing demand for new development, increasing population, loss and fragmentation of habitat, invasive non-native species and climate change.

Indicators in this chapter have been selected to give an overview of the state of biodiversity in the capital, assessing change over the last decade. The indicators address the coverage and condition of London's wildlife and geological sites (including all those considered to be of international, national and regional importance); enhancements and restoration of London's wildlife habitat; and changes in London's fish and bird populations and species diversity.

Case studies highlighting projects and schemes that demonstrate improvements to biodiversity and habitat, in London, are presented at the end of the chapter.

Indicator 19: Sites of Importance for Nature Conservation (SINC)

This indicator is a measure of the area, management and condition of SINCs, including Sites of Special Scientific Interest (SSSIs). There are just over 1500 SINCs in London. These include 36 nationally designated SSSIs; 29 are designated for their biological interest, containing nationally important habitats and species. The remaining 7 are designated for their geological interest[xxvii]. In addition, 5 of these sites are designated under European law and are part of the Natura 2000 site network[xxviii].

The protection of international and national designations is set out in law; whilst locally designated sites (e.g. SINCs) are protected through London's planning policies. London's SINCs cover around 30,000 hectares (ha) or around one fifth of Greater London. They are divided into 4 grades of importance: Sites of Metropolitan Importance (SMI), Sites of Borough Importance (SBI), which has 2 tiers, and Sites of Local Importance (SLI).

Designated wildlife sites are important to determine the state of the natural environment in London. They identify the amount and type of land in the capital that is of high enough quality to support a diverse range of habitats and species. Any gains in the number of designated sites and/or their coverage, demonstrates an improvement in environmental quality.

This indicator uses three datasets to measure change in London's SINCs; coverage (area and percentage) of SINC land, condition of SSSIs and the percentage of SINC sites in positive conservation management. Data used in this indicator is available to the report baseline of 2000, with the exception of data on the coverage of the SINC network, which was first collated in 2001, and data on sites in positive management (across the wider SINC network) which was only commissioned in 2009.

London's Foundations' was published in 2009 and the Geodiversity Action Plan finalised in 2010. These will provide invaluable baselines for future reporting.

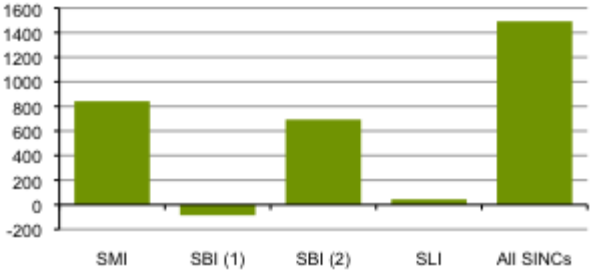
Analysis

- Between 2001 and 2012 there was a net gain of around 1,500 ha of SINC area. This equates to an increase of around 5%[xxix] (Figure 22).

- Net SINC coverage has increased, but there may have been losses at specific sites and the figures do not indicate quality. SINCs are semi-natural so require constant management to maintain their wildlife value.

SSSI land considered to be in favourable or recovering condition has increased from 73% in 2000 to 93% in 2012.

Figure 21
Change in area of SINC land in London, between 2001 and 2012
Hectares



Source: Greenspace Information for Greater London (GiGL, 2012

- The percentage of SINC sites under positive conservation management has increased from 42% in 2009, to 50% in 2010 and 59% in 2011. London is the highest performing part of the country, but there is still much potential for improvement.

- The majority of the improvement in SSSI condition occurred from 2007 onwards, at some of the larger sites e.g. Inner Thames Marshes and Richmond Park [xxx].

Indicator 20: Improving London's habitats

This indicator is a measure of the restoration and enhancement of different habitats in London, using data taken from the Biodiversity Action Reporting System (BARS). London's key wildlife sites, and the extent to which they are under appropriate management, provides the necessary protection to conserve London's biodiversity. However, they do not tell the whole story. If biodiversity is to be effectively conserved and resilient to pressures such as climate change, the extent of wildlife habitat needs to be expanded and the connectivity between it increased. Restoring and enhancing London's habitats is important for conserving the capital's wildlife and also contributes to improving the quality of life for Londoners. The Three Rivers Clean-up case study illustrates some of the action being taken in London to improve habitats.

Woodland habitat covers around 8% of London's total area, with around seven million trees providing around 22% canopy cover (7.4% woodland trees and 14.5% non woodland trees). Increasing canopy cover from street trees will help London adapt to the impacts of climate change, by helping to reduce the urban heat island effect, as well as providing habitat for woodland wildlife. The London Tree and Woodland Framework, a joint strategic overview produced by the Forestry Commission and the Mayor of London, sets objectives for improving the care and provision of London's trees and woodlands, and measures to retain and enhance them, increasing canopy cover.

This indicator looks at data on the area of habitat in London that is enhanced and restored. Habitat enhancement includes methods to improve habitat such as channel narrowing, removal of weirs and barriers and wetland creation. Habitat restoration includes measures that result in a significant improvement in the diversity of hydromorphological features and restoration of the river function.

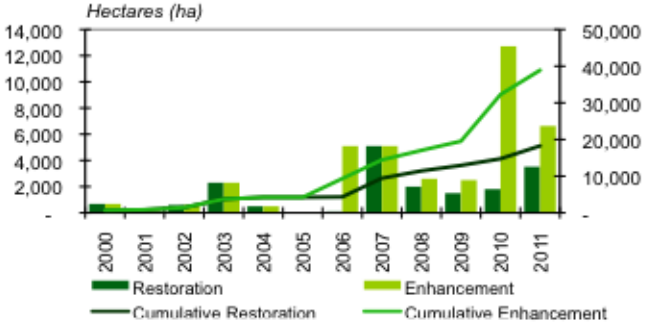
Due to the nature of the reporting, some of the figures may be underestimated. BAP targets are set for the creation and enhancement of BAP habitat, and are published on BARS to monitor progress.

Analysis

- London is making good progress in improving the extent and condition of BAP habitats.
- Almost 39,000 hectares have been enhanced in London since 2000 and over 18,000 hectares have been restored.

Work carried out to achieve these improvements include: the creation of a 4ha reed bed near Heathrow Airport; the restoration and expansion of 3.5ha of heathland at Mitcham Common, West Wickham Common, and Bostall and Sandmore Common; and the restoration of 0.7km of the River Roding.

Figure 22
Habitat restoration and enhancement in London since 2000



Source: BARS, 2012

Focus on ….. river habitats

Between 2000 and 2011, almost 40 km of river habitat in London has been improved including 18 km that has been restored[xxxi].

- Projects completed in 2011 enhanced 3.6km. The removal of Watney's weir and Beddington Park enhancements.
- 14km of river habitat have been restored since 2005, achieving 93% of the 2015 target of 15km.

Indicator 21: Bird populations

This indicator is a measure of change in populations of the most common bird species in London. Bird populations are an important proxy indicator of habitat quality in London. Birds require shelter, food and places to feed. Changes in population numbers can be directly affected by the quality of their habitat. We can encourage the protection and creation of suitable habitat by incorporating sustainability initiatives.

The data used in this indicator is taken from the RSPB's Big Garden Birdwatch survey (2012). This annual citizen science survey gives a snapshot of the birds living in participants' gardens. It runs over the last weekend of January every year, so excludes summer migrants.

It started nationally more than thirty years ago, but breakdowns for London have only been available since 2004. Therefore direct comparison to the report baselines is unavailable.

It's difficult to read anything in to annual fluctuations, but the survey does reveal long term population trends.

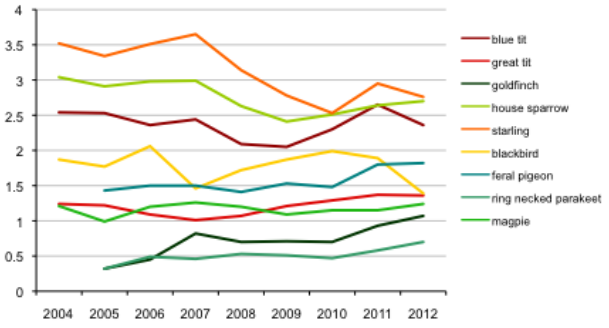
Analysis

- Over 300 species of bird have been identified in London in recent years[xxxii].
- Populations of common bird species in London, such as the starling, house sparrow and blackbird are falling (Figure 23).
- The starling has been in decline in London for some time, with no sign of a change in the trend. Since 2004, populations have fallen by around 22%.
- House Sparrow numbers fell dramatically in London over the past couple of decades, and have fallen by around 11% since 2004.
- Populations of the Wood Pigeon (a woodland bird) are doing well in urban gardens and parks and are seen on average in four out of every five gardens in London,
- Feral Pigeons have dispersed more widely across London following laws preventing feeding. They were recorded in 40% of gardens in the 2012 survey.

Overall bird populations London have increased by 15% between 2004 and 2012.

- London's blackbirds are in decline, falling by around 26% since 2004. The cause(s) are undetermined but the reductions in amenity grass and garden lawns could impact their ability to find food. Blackbirds were recorded in only 43% of gardens in the 2012 survey.

Figure 23
Populations of common bird species in London, 2004 to 2012



RSPB, Garden Birdwatch, 2012

Indicator 22: Fish populations

This indicator is a measure of the change in fish populations in the tidal Thames and fish status of the freshwater tributaries. Fish populations in the tidal River Thames have significantly improved since the early 19th century when major industry and polluting discharges limited the river's ability to sustain life. It now supports a diverse range of wildlife and provides a key fish nursery for many species such as sole, herring and bass which supports North Sea fish stocks. Since 1964 the tidal River Thames has recorded 125 species of fish along its length, from Teddington to the outer estuary at Tilbury, including BAP species such as eels, smelt, shad, lamprey and salmon. Each year around 40 of these species are regularly found in the river.

The freshwater tributaries of the River Thames support populations of mostly coarse fish. Historic land drainage, flood control, urbanisation and milling activities have created very artificial and culverted river channels that can seriously affect fish populations. The largest and most diverse populations are often found in the remaining pockets of natural channel and where river restoration projects have been undertaken. Recently, more sensitive flood risk management schemes are helping to improve fish populations in the freshwater tributaries. This is particularly evident in areas where culverts and concrete river channels, which were designed to assist the flow of water, are being restored to more natural river conditions and improving habitat.

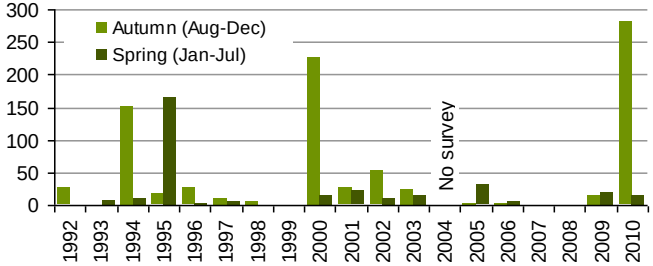
Fish stocks are sensitive to pollution, habitat changes and human activities, and therefore are a good indicator to assess the quality of our rivers. Data from routine fish surveys has been used to assess changes in smelt populations in the tidal Thames. Data has been used from 1992. To assess fish populations in the freshwater tributaries, data has been used from the Water Framework Directive assessments published in the River Basin Management Plan (2009). This uses survey data to classify the river depending on what species are found against those that might be expected.

Analysis

Tidal Thames (Figure 24)

- **Smelt**, a relative of the salmon which is very sensitive to water quality, complete their lifecycle in the tidal Thames. Populations fluctuate year on year, sometimes quite widely, but they have been relatively stable since 2000 (except some autumn peaks).
- **Salmon** populations died out in the River Thames in the 1830s due to pollution and habitat loss. Salmon returned to the river in the 1970s but remains at a low level.
- **Eels** re-colonised in the River Thames in 1960s after the improvements to water quality and habitat. A commercial eel fishery was established in the 1980s. Eel catches are relatively stable in the tidal Thames.

Figure 24
Smelt caught by Seine Net Surveys: Richmond to West Thurrock
Number of fish caught



Source: Environment Agency, 2010

Freshwater tributaries of the Thames

Under the WFD 6 river water bodies are currently achieving good or higher status for fish, 9 have moderate status, 14 have poor status and 18 are unclassified. Poor fish status includes parts of the Ravensbourne, Lee, Wandle, Rom/Beam, Quaggy, Brent, Shuttle River, Hogsmill, Pool, Beverley Brook and Crane.

Local case study

Improving habitat: The Three Rivers Clean up

The Three Rivers Clean-up took place on the rivers Quaggy, Ravensbourne and Pool in Lewisham, Greenwich and Bromley. Following success of the first programme in 2009, the scheme has been continued.

The programme delivered volunteering opportunities to benefit the local environment. The aim was to remove non-native invasive species such as Himalayan Balsam from the river banks and carry our litter picks.

Himalayan Balsam was introduced into Britain in 1839 as an ornamental garden plant. It escaped from gardens and quickly began to grow and colonise river banks, changing the natural characteristics of riverside vegetation, and impacting on the wildlife living in and around the rivers. It can also increase flood risk, when it dies back leaving the banks bare.

At the end of the nine day programme, over 350 volunteers had collected approximately 1,200 bags of Himalayan Balsam and around two truckloads of rubbish.

Environment Agency staff removes Himalayan Balsam and litter from the river as part of the Three Rivers Clean-up programme.
Source: Environment Agency. June 2009.

Useful links and further reading

- London Rivers Action Plan
- The Mayor's draft Biodiversity Strategy
- London Plan 2011. Policy 7.19 (Biodiversity and access to nature) and 7.20 (Geological conservation)
- The London Biodiversity Partnership – action plans and targets for London
- The Thames River Restoration Trust

Children enjoying the natural environment. Source: Natural England

8

LANDSCAPE AND GREEN INFRASTRUCTURE IN LONDON

Areas classified as deficient in access to nature have fallen in London, from 22% to 16% of the capital between 2006 and 2010.

The number of parks and green spaces awarded the Green Flag have increased from 12 to 264.

Although total Brownfield land has increased marginally, there has been a 42% reduction in the area of derelict land in London from 460 hectares (2002) to 268 (2009).

London is one of the greenest cities in the world. Viewed from the air, more than half of the area is green or blue – amazing for one of the world's major cities. Glass skyscrapers coexist with allotments, rivers, reservoirs, parks and gardens often supporting a surprising variety of wildlife.

London has 8 Royal Parks and numerous other garden squares, council parks and other green spaces such as Hampstead Heath. London's greenness is one of its strengths and should be supported and enhanced.

London's green infrastructure comprises the natural and designed green spaces and vegetated surfaces across London. Green infrastructure is the network of connected, high quality, multi-functional open spaces, corridors and the links in between that provide multiple benefits for people and wildlife[xxxiii]. These include:

- Improving health and general well-being by providing contact with nature, and places and spaces for recreation, leisure and food production.
- Managing flood risk by absorbing rainfall and slowing its eventual discharge into the surface water drainage system.
- Moderating the urban heat island through shading and evaporative cooling.
- Supporting a diverse range of wildlife.
- Reducing energy demand through shading and thermal insulation.
- Buffering noise and other forms of pollution.

The 'All London Green Grid' provides a green infrastructure framework that encourages increased wildlife habitat and ecological connectivity alongside other green infrastructure functions such as climate change adaptation and productive landscapes. This is explored further in the case study.

This chapter uses five indicators to look at the trends in landscape and green infrastructure in London. Focus is given to: London's green spaces (their quality, accessibility and use); Brownfield land (particularly the reduction in derelict land and its use for development); London's allotments and community food growing schemes; and urban greening in London (including green roofs and street trees).

Case studies highlighting the 'All London Green Grid' and 'Greening the Victoria Business Improvement District' are presented at the end of the chapter.

Indicator 23: Green spaces

This indicator is a measure of the change in quality and accessibility of London's green spaces. Here, green space includes all areas which are predominantly vegetated - natural green space. It doesn't include areas of open space that are primarily hard surfaced, such as urban squares, or areas whose function is exclusively limited to activities other than informal recreation (e.g. sports grounds), although there will be some overlap in these categories as green spaces can, and should, aim to fulfil different functions.

London's publicly accessible green spaces make up 16% of the capital. Although this is a significant area of London, the figure alone gives no indication of the quality of green space, access to it or people's engagement with them. This indicator uses the following datasets to measure change in London's green spaces.

- The Green Flag award. This scheme provides a measure of overall quality; recognising good quality parks and green spaces and associated site management based on 8 key criteria. Trends depend on the number of applications as well as site quality.
- Areas of Deficiency in Access to Nature (AoD). This looks at the areas in London where people have poor access to nature (where people have to walk more than 1 km to reach a SINC of at least borough grade importance) and is based on London's SINCs.
- AoD to publically open spaces looks at the distance residents have to travel to reach POS, by type. Data is for 2012.
- Monitor of Engagement with the Natural Environment (MENE) survey. This was commissioned by Natural England, Defra and the Forestry Commission in 2009 to provide a measure of how people use the natural environment across the country.

Comparison to the report baseline is only available for the Green Flag Award. All other datasets present current position.

Analysis

- Since 2000, the number of parks or green spaces awarded the Green Flag has increased from 12 to 264. They now have one of the highest concentrations in the country[xxxiv].

- Since 2006, the area of AoD in **access to nature** has fallen from 22% to 16% of London.[xxxv]
  - 24,816 ha are classified as AoD in 2010, 9,423 ha less than in 2006.
  - The majority of this decrease is likely to have been achieved either by creating access to sites where there has previously been none or creating new access points to sites already accessible to the public.

Table 8: AoD to publically open space

Type of POS	Area of AoD
Regional	103,609 ha
Metropolitan	41,342 ha
District	71,924 ha
Local	80,082 ha

The following headline results are from an analysis of MENE survey[xxxvi] data collected between March 2009 and February 2012:

- Londoners take over 80% of their outdoor visits within Greater London.
- Parks are of fundamental importance accounting for nearly 62% of all outdoor visits.
- Visits to green space in London are motivated by a social purpose that is not as strong outside of London.
- 29% of outdoor visits are taken for health and exercise, much lower than England as a whole (38%).
- However 91% of Londoners agree that visits to the natural environment make them feel calm and relaxed.
- 82% of Londoners feel that spending time out of doors (including their own garden) is an important part of their life.
- 9 out of 10 Londoners think that green space close to home is important.

Indicator 24: Bringing land back into beneficial use

This indicator is a measure of the change in different types of Brownfield land in London. Brownfield land describes land that was previously developed, and is now either derelict, vacant or currently in use with the potential to be redeveloped. There are currently 3,730 hectares of Brownfield land in London (2009) – around 2% of the capitals' land area.

Some Brownfield land in London may be damaged or contaminated from previous uses, and may therefore require treatment before it can be turned into beneficial use. Redevelopment provides the opportunity to remediate this land. Brownfield land is not always contaminated and often provides important wildlife habitat and public open spaces. It is important to recognise the habitat and biodiversity value of Brownfield land, and manage loss of habitat through development, e.g. through living roofs.

The redevelopment of Brownfield land can bring benefits to local communities and the environment, by reducing the pressure on London's green spaces from development and reducing the area of derelict land.

The data for this indicator is taken from the National Land-use database, held by the Homes and Communities Agency (HCA), and from the Environment Agency. The latest data available for Brownfield land is 2009 and data are not available for the report baseline of 2000. Comparisons will therefore be made to 2002, the earliest and most robust dataset available.

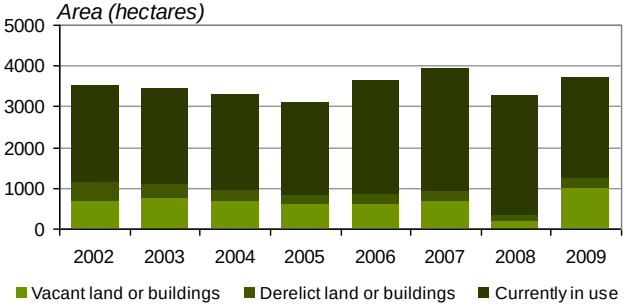
Analysis

- The area of derelict land or buildings in London has decreased by 42% since 2002, from 460 to 268 hectares (ha) (Figure 25).
  - There has been a shift in the boroughs that have the largest areas of derelict land or buildings. In 2001 Greenwich had 107 ha (30% of the London total). In 2009 Newham borough had the largest area, at 56 ha (21% of the London total).
  - 8 London boroughs have no reported derelict land or buildings.

- The area of vacant Brownfield land in London has increased by 47% since 2002, from 670 ha to 982 ha in 2009.

- The area of Brownfield land currently in use in 2009 is 2,481 ha, an increase of 100 ha since 2002.
  - The area currently in use with planning permission or allocated in a local plan increased by 11%, from 1,920 ha (2002) to 2,132 ha (2009).
  - The area with redevelopment potential decreased until 2005, then increased to 349 ha.

Figure 25
Brownfield land in London
Area (hectares)



Source: HCA

- New properties built on Brownfield land have increased from 89% in 2000, to 96% in 2009[xxxvii].

- Around 1,440 hectares of land affected by contamination was brought back into beneficial use between 2000/01 and 2011/12. 68% was risk assessed and 32% was remediated.

Indicator 25: Allotments and food growing spaces

This indicator is a measure of the number and coverage of London's allotments and food growing spaces. Over recent decades there has been a reduction in allotment sites, in London, with many being sold for development. However, data from the London boroughs suggests this trend is being reversed with numbers of allotment sites increasing in the last few years. Some allotment sites in the capital have a waiting list of several years.

Local allotments and food production improves the state of the environment by increasing the area of green space, creating wildlife havens in urban centres and reducing carbon emissions associated with transporting food as residents reduce the amount of food purchased by growing locally. It also has the added benefit of improving community cohesion.

The Capital Growth scheme was launched in November 2008. This is an innovative scheme to turn 2,012 pieces of land into thriving food growing green spaces by the end of 2012. The scheme aims to identify suitable patches of land around London and offer financial and practical support to groups of enthusiastic gardeners or organisations who want to grow food for themselves and for the local community. By May 2012, there were over 1,700 Capital Growth spaces; including land in schools, hospitals, housing estates, utility companies and parks, and over 40,000 Londoners were involved.

This indicator uses data on London's allotments and food growing spaces. Due to the irregularity of surveys, there is no consistent data available to analyse a clear trend over time. Data are taken from different surveys and reports to create a picture of London's allotments. In particular, the indicator uses data supplied by the boroughs, to the Greater London Authority. For 2010, only 22 boroughs provided data so the trend has been calculated based on these boroughs for previous years to allow comparison.

Analysis

- A 2007 study by the Greater London Authority suggests that allotments in London cover around 1,000 hectares.
- There are 507 allotments sites in the 22 boroughs the Greater London Authority have received 2010 data for. Previous assessments with complete data (in 2007) estimated that within all 33 boroughs there are over 700 allotment sites in London, containing around 25,000 plots[xxxviii].

Allotment sites in London increased by 13% between 2003 and 2010, from 448 to 507 sites.

- However, the 2006 London Assembly Environment Committee report 'A Lot to Lose' estimated that 1,534 allotment plots were lost over the last decade. This was estimated to be over 35 hectares of allotment land[xxxix].
- Londoners currently grow over 8,000 tonnes of fruit and vegetables a year[xl].
- Levels of interest in people growing their own food are at the highest level for decades; partly due to environmental concerns over food production.

Demand for allotments is increasing in London
Source: Environment Agency

Indicator 26: London' garden cover

This indicator is a measure of the area of land in London that is garden. Almost one quarter of Greater London's surface area is private, domestic garden land – it is calculated that around 3.8 million garden plots (including fronts and backs) make up the total area of almost 37,900 hectares[xli].

Private gardens provide many people with daily contact with nature and form a pleasant component of residential areas. A single garden may provide habitat for a range of plants and wildlife. Notable gardens species in London are the hedgehog, house sparrow, common frog and stag beetle.

On a broader scale, gardens significantly contribute to the green infrastructure of a city. Their habitats are becoming an important resource for conserving some species, they absorb rainfall reducing the effects of flooding and their vegetated areas help to keep the city cool. Each of these roles is important to London and likely to become more so with predicted effects of climate change.

A new study by London Wildlife Trust, Greenspace Information for Greater London (GiGL) and the Greater London Authority, published in 2011, examines the change in private garden land cover between two time periods, 1998/99 and 2006-08. Land cover was determined by comparing colour aerial photographs taken in 1998 and 1999 with ones taken in 2006 and 2008, using random sample plots taken from each borough. From the photographs it was possible to see the area covered by lawn, tree canopy or hard surfacing in each sample plot and then scale this up to estimate the total areas in London.

This dataset will not be updated in future reports; it is a snapshot of the situation at the time of the study.

Analysis

- The composition of London's gardens is changing at a significant rate. An area of vegetated land around 2.5 times the size of Hyde Park is being lost every year and the amount of hard surfacing in the capital's gardens has grown significantly.
- 57% (22,000 hectares) of London's garden land is vegetated cover - lawn, tree canopy and other vegetation (2006-08).
- The study shows that between 1998-99 and 2006-08:
  - The area of vegetated garden land declined by 12%, a loss of 3,000 ha.
  - The amount of hard surfacing in London's gardens increased by 26% or 2,600 ha.
  - The area of garden buildings (sheds etc.) increased by 55% or 1,000 ha.
  - The amount of garden lawn decreased by 16% or 2,200 ha.

The changes in garden cover are primarily due to many small changes to individual gardens as part of their management and use by homeowners, rather than large scale changes or housing development on garden land (although this can result in significant loss of garden land at a local level)[xlii].

Gardens in the Clapton Park Estate, Hackney
Source: John Little

Indicator 27: Urban greening

This indicator provides a measure of the level of urban greening in the capital, with a focus on green roof cover and street trees. 'Urban Greening' refers to green infrastructure that is incorporated into the most densely developed urban areas. This includes tree planting, soft landscaping and green roofs and walls.

Urban greening measures offer numerous benefits to the environment and are encouraged through the London Plan. These include increased biodiversity, improved health and wellbeing, energy savings, reductions in CO_2 emissions and air quality improvements, and surface water management.

There are two types of green (vegetated) roof in London. Intensive green roofs are principally designed to provide amenity and are normally accessible for recreational use. They may be referred to as roof gardens or terraces. Generally intensive green roofs comprise a lush growth of vegetation and are based on a relatively nutrient rich and deep substrate. Extensive green roofs generally provide greater biodiversity interest than intensive roofs, but are considered to be less appropriate in providing amenity and recreation benefits since the substrate depth is considerably shallower, therefore only supporting smaller plants. Green roofs offer numerous environmental benefits including energy saving, storm water management and biodiversity enhancement.

Street trees are another important component of urban greening, providing environmental and economic benefits as well as making our public spaces more attractive. Initiatives like the Mayor's street tree programme are helping to increase London's street tree cover. The species mix of street and urban trees, planted in London, is changing in favour of smaller, shorter lived species. This is likely to affect future canopy cover if left unchecked.

This indicator looks at the number and area of green roofs in London and the numbers of street trees. The data on street trees is taken from Livingroofs.org and the Greater London Authority, and was first collected in 2004. Comparison with the report baseline is therefore not available, but trends have been drawn from 2004. The data on street trees is taken from the London Assembly report 'Branching Out – The future of London's street trees' (April 2011). This provides current figures; trends are not available.

Analysis

- Tree canopy cover in London is 21.9%. This is made up of 7.4% woodland trees and 14.5% non-woodland trees e.g. street trees.
- There are over 13,000 hectares of woodland in London[xliii]. Around 26% of this is managed woodland (3,300 ha), compared to an average of 52% in England.
- 10,221 street trees were planted under the Mayor's Street Tree programme between 2008 and 2012.
- Over 20,000 trees were planted in 2012 by local communities as part of the Community Grant Scheme.
- The Big Tree Plant will see around 65,000 trees being planted in London from 2012 to 2015.
- It was estimated that London had approximately 500,000m^2 of green roof cover at the end of 2008; equivalent to around 70 football pitches. This area has increased significantly since 2004.
- Transport for London removed 2,255 trees between 2009/10 and 2011/12 along their networks, primarily due to health and safety and the removal of dead or diseased trees. They planted 3,117 new trees to offset this, creating a net increase of 862 trees.

Local case studies

The All London Green Grid
The green grid concept aims to provide Londoner's with a multi-functional network of open space, improving quality of life. This project has two key drivers: climate change and regeneration. The aim of the green grid is to create a network of interlinked, multi-functional and high quality open spaces that connect with town centres, public transport nodes, the countryside in the urban fringe, the River Thames and major employment and residential areas. It envisages the creation of new public spaces, the enhancement of existing open spaces and improvements to the links in between.

The All London Green Grid has its origins in East London and the East London Green Grid, which was awarded the 2008 Landscape Institute's President's Medal and Strategic Landscape Project Award. This success has been recognised by the Mayor as a policy in The London Plan and the All London Green Grid Supplementary Planning Guidance (SPG) which was published in 2012.

The All London Green Grid comprises 11 Area Frameworks, with a group of local stakeholders to govern delivery in each Area. These Area Frameworks will be launched at the end of 2012 with a mayoral fund to support delivery. The ALGG promotes a range of green infrastructure functions based on the following strategic objectives:

- Adapt to climate change and promote urban greening.
- Increase access to open space.
- Increased access to nature and to conserve and enhance biodiversity.
- Improve sustainable travel connections.
- Promote healthy living.
- Conserve and enhance heritage features and landscape character.
- Enhance green space and green infrastructure sector skills.
- Promoting sustainable food production.
- Promote sustainable design, management and maintenance.
- Enhance distinctive destinations and boost the visitor economy.
- Improve air quality and sound scapes.
- Improve the quality of and access to the Greenbelt and the urban fringe.
- Conserve and enhance the Thames and tributaries riverside spaces.

Green roofs: Living Roof - The Ellen Wilkinson School for Girls (Ealing)
Dry grassland and Brownfield habitats play a key role in supporting urban wildlife, including invertebrates, plants and birds. In London Brownfield sites have been the focus of redevelopment and regeneration. Consequently, it is likely that the majority of existing Brownfield habitats will have disappeared within the next decade. The incorporation of green roofs (amongst other measures), into new and existing developments, can help offset this loss.

Wishing to actively encourage biodiversity in its neighbourhood, the Ellen Wilkinson School for Girls in Ealing, decided to support the living roof initiative in the design of its new Learning Resource Centre. Steps were taken to ensure that the new roof would incorporate a range of habitats suitable for rare invertebrates and birds, with the substrate chosen offering the greatest benefit for invertebrate conservation and diversity.

The 275 m^2 roof, laid in October 2010, joins six other living roofs across London which is being monitored for their ecological performance. Partners of the project include the Sita Trust, Living Roofs and Buglife.

Data gathered by this project will contribute to existing knowledge on managing habitats for Brownfield invertebrates, as well as helping to inform the development of a regional mitigation

strategy for the conservation of the nationally important invertebrate resource.

The project helped to deliver national, regional and local Biodiversity Action Plan targets, including the national 'Open Mosaic Habitat on Previously Developed Land' Habitat Action Plan (HAP); the London Wasteland HAP; the Brown Banded Carder Bee Species Action Plan; and the London Biodiversity Partnership's Built Environment Action Plan.

In recognising the importance of a green roof in attracting local wildlife and contributing to the educational experience of pupils, the school believes its living roof will encourage the next generation to look after the environment.

Green Infrastructure: Victoria Business Improvement District (BID)

Victoria was redeveloped during the 1960s and is now a densely built up area of London with little green space. Local businesses were keen to encourage improvements to forge a strong positive identity for the area and encourage visitors to stay longer. In 2010, they launched the Victoria Business Improvement District (BID). Each business within the Victoria BID area makes a financial contribution based on its rateable value which goes to fund improvements.

As part of their 'Clean and Green' programme, the BID undertook an audit of opportunities to increase and improve the green infrastructure resource including locations suitable for green roofs, green walls, rain gardens and planting of additional street trees. It is thought that this is the first time anywhere that mapping of green infrastructure opportunities at this level of detail has been carried out and it has become a model for 11 other London BIDs. 25 hectares of potential green roofs, 1.25 hectares of terrestrial green infrastructure and 1.69 hectares of improvements to existing infrastructure were identified.

Flooding has been recognised as one of the most significant environment problems for the area. On several occasions, flooding from heavy downpours has closed Victoria Underground Station with a consequent loss of business. The audit estimated that improving green infrastructure would have considerable financial benefits due to savings reducing the effects of flooding. It calculated that if all potential 25ha of green roofs were fitted, they could attenuate as much as 80 million litres of storm water a year.

The BID also commissioned a study into the current condition of Victoria's street trees. Using a method developed in the US, the Victoria iTrees study assessed the benefits trees provide in terms of carbon sequestration, pollution reduction, temperature regulation and attenuation of storm water, and whether different species provide a different level of benefit. The study showed that Victoria supports 1,225 trees of 140 different species. These trees remove 1.15 tonnes of pollutants from the air around Victoria each year, representing a cost saving to society of £86,000. Victoria trees have 847 tonnes of carbon locked away in their woody parts, and remove a further 18 tonnes from the air. However, the study identified that many of Victoria's street trees are mature and will need replacing if they are to continue providing these benefits.

Work to implement improvements is now underway. The project will test and demonstrate how to build green infrastructure into existing built infrastructure in a heavily built up area. Planning permission for a new rain garden has been granted, the first ever to be installed in London. In addition, local beekeeping has been encouraged with the setting up of nine beehives and the establishment of the Bee Collective, an innovative social enterprise, which processes honey on behalf of beekeepers and returns profits to the environment.

Useful links and further reading

- Green spaces: London Plan 2011. Policy 2.18 (green infrastructure: the network of green and natural spaces) and 7.18 (protecting local natural space and addressing local deficiency)

- Allotments: London Plan 2011. Policy 7.22 (land for food)

- Urban greening: London Plan 2011. Policy 5.10 (urban greening), 5.11 (green roofs and development site environs) and 7.21 (trees and woodlands)

- Victoria BID Green Infrastructure Audit

Glossary

The adopted London Plan is the Spatial Development Strategy for London that first published in 2004 and later updated in 2008. It provides a spatial framework for Mayoral strategies up to 2026.

The London Plan 2011 is the new London Plan, put forward by the Mayor following a complete review. It looks forward to 2031. It has replaced the adopted London Plan, and will form part of the statutory development plan for Greater London.

Climate change

- **The London Energy and Greenhouse Gas Inventory** is a tool which provides data on greenhouse gas emissions and energy consumption in London.
- **Scope 1 emissions (direct)** are defined by Defra as 'emissions from activities and sources you control, such as vehicles you own and operate'.
- **Scope 2 emissions (energy indirect)** are defined by Defra as 'emissions associated with your consumption of purchased electricity, heat, steam and cooling, for heating your offices, for example. They result from your use of energy but take place somewhere else and are not under your direct control'.
- **Scope 3 emissions (other indirect)** are defined by Defra as 'emissions that are a consequence of your actions, which occur at sources which you do not own or control (other than scope 2), such as your suppliers emissions'.
- **UKCP09** are the UK climate projections released by the UK Climate Impacts Programme in 2009. They provide projections of our future climate taken from climate models, at a national and regional level. They use three different scenarios: high, medium and low emissions to look at different variations in climate. This is an update to the projections released under UKCP02.
- **RE:NEW** is a scheme that aims to improve the energy efficiency of homes across London, through advice and installation of energy efficient appliances like energy saving light bulbs, insulation for hot water tanks and shower timers.
- **RE:FIT** is a scheme that helps public bodies retrofit their buildings to be more energy efficient and reduce their carbon emissions and costs.
- **The Code for Sustainable Homes** is 'the national standard for the sustainable design and construction of new homes'. The code aims to reduce our carbon emissions and create homes that are more sustainable'[xliv]. It has levels one to six, each with standards for water and energy.
- **Decentralised Energy (DE)** describes the generation of energy 'on-site' or closer to the point of consumption, often via smaller scale sites. This reduces the distance energy is transported and reduces loss during transportation.

Flood risk

- **Impermeable** describes a surface that does not allow the flow of water through it, for example concreted roads or pavements.
- **Tidal floodplain** describes the area of land alongside an estuary that can experience flooding.
- **Fluvial floodplain** describes the area of land alongside rivers that can experience flooding during high flows when the flow exceeds the channel capacity.
- **Planning Policy Statement 25 (PPS25)** is the government's spatial planning policy on development and flood risk.
- **Thames Estuary 2100 (TE2100)** is a project led by the Environment Agency to develop a long-term tidal flood risk

management plan for London and the Thames Estuary.

- **Drain London** is a project set up following the Pitt Review, to assess the risk of surface water flooding in London.
- **Peak surge tide levels** describe the highest level of the tide following a storm surge. This occurs as a result of low pressure weather systems rising water levels out at sea as high winds raise the level of water on the sea's surface.
- **The Flood Risk Appraisal** is the regional appraisal for London carried out by the Greater London Authority. It is related to the flood risk policies in the London Plan 2011, and makes recommendations to improve understanding and management of flood risk in London.
- **The Flood and Water Management Act 2010** implements the recommendations made by Sir Michael Pitt following his review of the 2007 floods. More information can be found on the Defra website.

Water quality

- **Diffuse pollution** comes from scattered or dispersed sources that are collectively significant but to which effects are difficult to attribute individually.
- **Point source pollution** describes pollution arising from an identifiable or localised point such as a discharge pipe or landfill site.
- **Combined Sewer Overflow (CSO)** occurs when the overflow pipes connected to the combined sewerage system overflow. Heavy rain puts pressure on the drainage system as the volume of water passing through it increases. When the volume exceeds the capacity of the pipes, discharges of diluted sewage are made into rivers or the sea, through outfalls.
- **The EU Water Framework Directive** (WFD) is a major piece of European legislation that was written into UK legislation in December 2003. It aims to improve the health of the water environment and promote the sustainable use of water.
- **The River Basin Management Plan** sets out the environmental objectives for all the water bodies within the River Basin District and identifies how they will be achieved. The plans are based on a detailed analysis of the pressures on the water bodies and an assessment of their impacts. The plans must be reviewed and updated every 6 years.
- **Ecological Status** applies to surface water bodies and is based on the following quality elements: biological quality, general chemical and physico-chemical quality, water quality with respect to specific pollutants (synthetic and non synthetic) and hydromorphological quality. There are five classes of ecological status: high, good, moderate, poor and bad.
- **Ecological Potential** identifies the status of a heavily modified or artificial water body measured against the maximum ecological quality it could achieve given the constraints imposed upon it by those heavily modified or artificial characteristics necessary for its use. There are five ecological potential classes for heavily modified or artificial water bodies: maximum, good, moderate, poor and bad.
- **Heavily Modified Water Body** is a surface water body that does not achieve good ecological status because of substantial changes to its physical character resulting from physical alterations caused by human use, and which has been designated in accordance with criteria specified in the Water Framework Directive as 'heavily modified'.

Water resources

- **Catchment Abstraction Management Strategies (CAMS)** look at the amount of

resource available against the amount licensed for abstraction to ensure a balance.

- **The hydrometric achieve** is a database containing river flows, levels, groundwater levels and rainfall data from continuous monitoring stations across England and Wales .
- **The Future Water Strategy** is a Defra strategy, published in February 2008 that identifies the government's vision and priorities for water in England.
- **The Water Company June returns to Ofwat** is a report made each year to the regulator Ofwat, giving information on various aspects of performance (e.g. different types of consumption, leakage, population served), as well as various compliance indicators, all accompanied by an overview and review by an independent consultant.
- **Retrofitting** describes the installation of measures or devices, e.g. to reduce water use, in existing developments that don't currently have them.

Waste

- **Local authority collected waste** describes all the waste collected by the local authority (formerly referred to as municipal solid waste (MSW). It is household waste and local authority collected commercial waste. Defra have recently revised the definition of MSW to ensure the UK is meeting landfill diversion targets under the Landfill Directive.
- **Commercial and industrial waste (C&I)** describes all the waste that is produced as a result of commercial or industrial activities, and can also be referred to as 'business waste'.
- **Construction and demolition waste (C&D)** describes all the waste produced directly or indirectly through construction and demolition activities. It includes, brick, wood, concrete and other building materials.
- **The Landfill Allowance Trading Scheme** is a government initiative aimed at reducing the amount of biodegradable municipal waste going to landfill. Each local authority has an allowance for the amount of biodegradable waste they can send to landfill in a given year. They can then decide how to allocate this allowance – whether to use it, trade it with other local authorities or save it to use in the future.
- **Biodegradable Municipal Waste (BMW)** is predominantly household food waste and green waste that is biodegradable and will break down within a landfill site.
- **The Best Value Performance Indicators** are a series of indicators set by the government to measure local authority performance on a range of issues. The data is collected and reported by the Audit Commission on an annual basis.

Air, transport and noise

- **Nitrogen dioxide (NO_2)** is an air pollutant which predominantly comes from road transport and power stations.
- **Particulate matter (PM_{10})** describes the tiny particles of solid matter, suspended in the air, with a diameter of 10 micrometers or less.
- Transport mode share at **journey stage level** brings together the different segments of a trip, with each stage using a single mode of transport. This is different to the trip level, which only relates to the mode of transport used for individual trips.
- An **Air Quality Management Area (AQMA)** is declared where a local authority has assessed an area as unlikely to achieve air quality objectives, following assessment of current levels and predictions for future change.
- **The London Air Quality Network** holds air quality information, providing hourly or daily updates from monitoring sites around the capital.
- **The London Low Emissions Zone** is a charging scheme, introduced in 2008, that aims to reduce the most polluting vehicles in central London. There is a charge for those vehicles with particulate

emissions over a set standard. These standards will become more stringent from January 2012.

- **Airport noise contours** are a graphical indication, displayed as lines on a map, of places around an airport that are exposed to particular noise levels.
- **Planning guidance (PPG24)** is a planning guidance document for local authorities on minimising the adverse impacts of noise.

Biodiversity

- **The Biodiversity Action Plan (BAP)** was published in 1994 and aims to help conserve and protect the UK's most threatened species and habitats. Local actions plans have been established within this, to address biodiversity at a local level. Progress with these plans is measured every 3 years.
- ***Sites of Metropolitan Importance*** **(SMI)** are the most important of the capital's wildlife sites such as Rainham Marshes and the chalk downlands of South London. They include all the SSSIs as well as some of London's premier parks and green spaces, such as the Royal Parks. They cover just over 10% of Greater London.
- ***Sites of Borough Importance (SBI)*** are sites that are important within the context of the borough and include woodlands, meadows, rivers and ponds. There are two grades which indicate differences in quality. They cover just over 7% of Greater London.
- ***Sites of Local Importance (SLI)*** includes some of the smaller sites which are nevertheless extremely important to local communities in enabling them to experience nature close-by. They cover just over 1% of Greater London.
- **The Biodiversity Action Reporting System (BARS)** allows the assessment of progress with the Biodiversity Action Plan.

Landscape and green infrastructure

- **Green infrastructure** describes the network of connected, high quality, multi-functional open spaces and corridors in London and the links between them that provide benefits for people and wildlife.
- **The All London Green Grid** is an extension of the original project on the East London Green Grid. This aimed to create, improve, manage and maintain high quality of open spaces and green infrastructure for people and wildlife.

Appendix

Appendix 1: Areas of Responsibility

Climate change: Greater London Authority, Department for Energy and Climate Change, London Boroughs, Defra
Flood risk: Environment Agency, Greater London Authority, London Boroughs, Defra

Water quality: Environment Agency, Defra, Water Companies operating in London, British Waterways, Port of London Authority

Water resources: Environment Agency, Greater London Authority, Defra, Water Companies operating in London, OFWAT

Waste: Environment Agency, Greater London Authority, London Waste and Recycling Board, London Boroughs, London Waste Authorities, Defra

Air quality: Greater London Authority, London Boroughs, Defra

Transport: Transport for London, Greater London Authority, London Boroughs

Noise: Greater London Authority, London Boroughs

Biodiversity: Natural England, Environment Agency, Greater London Authority, Forestry Commission, London Boroughs, Defra, Royal Parks, Port of London Authority

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Chinese
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Vietnamese
Nếu bạn muốn có văn bản tài liệu này bằng ngôn ngữ của mình, hãy liên hệ theo số điện thoại hoặc địa chỉ dưới đây.

Greek
Αν θέλετε να αποκτήσετε αντίγραφο του παρόντος εγγράφου στη δική σας γλώσσα, παρακαλείστε να επικοινωνήσετε τηλεφωνικά στον αριθμό αυτό ή ταχυδρομικά στην παρακάτω διεύθυνση.

Turkish
Bu belgenin kendi dilinizde hazırlanmış bir nüshasını edinmek için, lütfen aşağıdaki telefon numarasını arayınız veya adrese başvurunuz.

Punjabi
ਜੇ ਤੁਹਾਨੂੰ ਇਸ ਦਸਤਾਵੇਜ਼ ਦੀ ਕਾਪੀ ਤੁਹਾਡੀ ਆਪਣੀ ਭਾਸ਼ਾ ਵਿਚ ਚਾਹੀਦੀ ਹੈ, ਤਾਂ ਹੇਠ ਲਿਖੇ ਨੰਬਰ 'ਤੇ ਫ਼ੋਨ ਕਰੋ ਜਾਂ ਹੇਠ ਲਿਖੇ ਪਤੇ 'ਤੇ ਰਾਬਤਾ ਕਰੋ:

Hindi
यदि आप इस दस्तावेज की प्रति अपनी भाषा में चाहते हैं, तो कृपया निम्नलिखित नंबर पर फोन करें अथवा नीचे दिये गये पते पर संपर्क करें

Bengali
আপনি যদি আপনার ভাষায় এই দলিলের প্রতিলিপি (কপি) চান, তা হলে নীচের ফোন্ নম্বরে বা ঠিকানায় অনুগ্রহ করে যোগাযোগ করুন।

Urdu
اگر آپ اِس دستاویز کی نقل اپنی زبان میں چاھتے ھیں، تو براہ کرم نیچے دئے گئے نمبر پر فون کریں یا دیئے گئے پتے پر رابطہ کریں

Arabic
إذا أردت نسخة من هذه الوثيقة بلغتك، يرجى الاتصال برقم الهاتف أو مراسلة العنوان أدناه

Gujarati
જો તમને આ દસ્તાવેજની નકલ તમારી ભાષામાં જોઈતી હોય તો, કૃપા કરી આપેલ નંબર ઉપર ફોન કરો અથવા નીચેના સરનામે સંપર્ક સાધો.